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THE MARINE ALGÆ OF THE DANISH WEST INDIES

VOL. II. RHODOPHYCEÆ

WITH ADDENDA
TO THE CHLOROPHYCEÆ, PHÆOPHYCEÆ
AND RHODOPHYCEÆ

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INTRODUCTION

As was the case with the parts of "The marine Algæ of the Danish West Indies" published earlier, this third part, containing the *Rhodophyceæ*, is based especially upon materials collected during my three stays at the islands.

With regard to West Indian Red Algæ I have already published some papers on the subject, namely:

Some new or little known West Indian Florideæ, I. (Botanisk Tidsskrift, 30. Bind, København 1909).

Some new or little known West Indian Florideæ, II. (Botanisk Tidsskrift, 30. Bind, København 1910).

For the sake of completeness I have included here the principal contents of these papers.

The Red Algæ are common in the litoral region and also in the upper sublitoral, but they occur especially in deep water, and where I succeeded in dredging in such places I always had good results.

Thus they occurred abundantly in the Sound between St. Thomas and St. Jan. Strong currents run here in the narrow channel and steadily renew the water. The depth varies from 10 to about 20 fathoms, seldom more. The bottom is suitable for dredging; it consists of smaller and larger stones, pieces of corals etc. Upon these a very rich vegetation of algæ is present, mostly consisting of Red Algæ. Also north of St. Jan, in the narrow sound between this Island and Tortola, a flourishing algal vegetation is found, including especially many Red Algæ.

At St. Thomas I have dredged in the sea around Water Island. At a depth of about 10 fathoms and upon sandy, loose bottom a vegetation of *Udotea* and *Halimeda* was found, together with several Florideæ.

At St. Croix the dredgings were mostly not successful on account of the coral reefs which almost entirely surround the island. Only in the sea near Buck Island have more successful dredgings been undertaken.

I much regret that I have not succeeded in dredging in deeper water than about 20—25 fathoms; as pointed out in the introduction to the *Chlorophyceæ* section, my attempts at this were negative, the dredge being immediately lost in the rocky bottom.

But it is not only in deep water that the Red Algæ occur; also in shallow water near the shore they are often found in great numbers. In connection with this may also be borne in mind the rich algal vegetation upon the roots of the mangroves and among which the red algæ are very prominent.[1])

With regard to the physiographical details, coral reefs, depths etc. and also to localities visited, reference should be made to the introduction to the section on the *Chlorophyceæ*; in this part moreover a chart is published showing the coral reefs, depths etc. in the sea surrounding the islands.

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[1]) Compare my treatise: "The algal vegetation of the lagoons in the Danish West Indies" in "Biologiske Arbejder tilegnede Eug. Warming den 3. November 1911", p. 41.

RHODOPHYCEÆ

A. Protoflorideæ.

I. Bangiales.

Fam. 1. ***Bangiaceæ.***

Subfam. 1. Goniotrichieæ.

Asterocytis Gobi.

1. Asterocytis ramosa (Thwaites) Gobi.

Gobi, C., in Arbeiten St. Petersb. Naturf. Ges., Bd. X, 1877, p. 85. Schmitz, Fr., in Nuova Notarisia, 1894, p. 717; id. in Engler u. Prantl, Nat. Pflanzenfam., I. Part, 2. Abt., p. 314. Wille, N., Algolog. Notiz., I—IV (Nyt Magazin f. Naturv., Bd. 38, 1900, p. 7, tab. 1, figs. 8—14). Rosenvinge, L. Kolderup, The marine Algæ of Denmark, 1909, p. 77.

Hormospora ramosa Thwaites in Harvey, Phycologia Brit., pl. 213.

Goniotrichum ramosum Hauck, Meeresalg., p. 517. Batters, Mar. Alg. Berwick, p. 13; Lakowitz, Algenfl. Danziger Bucht, 1907, p. 79.

Growing upon specimens of *Liagora elongata* I have several times found a small alga which undoubtedly belongs to this genus and as these specimens seem to differ in no essential way from *A. ramosa* I have referred them to it.

The specimens found were often rather large and repeatedly branched (Fig. 1 *a*); in some specimens the vegetative cells were nearly globular or subquadrate, about as long as broad, in others the cells were oblong or ellipsoidal (Fig. 1 *b*).

This plant has been recently examined in detail by Wille (1900, l. c.) and by Rosenvinge (1909, l. c.). Wille describes the setting free of the spores which is as pointed out by Rosenvinge in accordance with the earlier description of Schmitz. Wille describes furthermore some few cells with membranes which he supposes to be akinetes. Rosenvinge has now stated that the supposed akinetes of Wille are really such. He was fortunate enough to find filaments in which nearly all the cells were transformed to akinetes.

In my material also I have found several times filaments in which the most part of the cells were transformed to akinetes (Fig. 1 *d*). These cells had each a very thick wall (about 2 μ thick) of a firm consistency, while on the other hand the common membrane in the whole filament is thin agreeing with the description of ROSENVINGE.

The akinetes escape through a hole in the membrane of the filament (comp. fig. 1 *d*). They have very dense granular contents and are often oblong, sometimes also globular or ellipsoidal; their diameter reaches a length of about 14 μ.

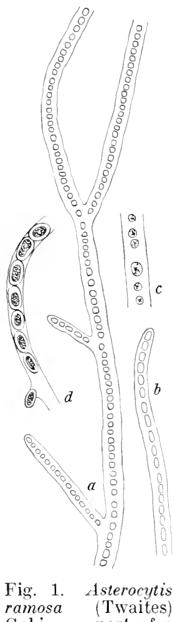

Fig. 1. *Asterocytis ramosa* (Twaites) Gobi. *a*, part of a plant. *b*, summit of a filament with longer cells. *c*, cells with chromatophore. *d*, part of a filament with akinetes. (*a* and *b*, about 125:1, *c* and *d*, about 200:1).

The filaments reach a thickness of about 16—21 μ, while the vegetative cells are about 6—7 μ. In one case a specimen was found in which the main filament was about 25 μ and the diameter of the cells about 10 μ while the branches only reached the thickness mentioned above. ROSENVINGE also mentions that he has found a single specimen of a similar thickness. The chromatophore is, as well known, starlike (Fig. 1 *c*).

Having only examined specimens preserved in spirit I cannot say anything as to the colour of the plant. As several authors have stated that they have found *Asterocytis ramosa* in brackish water (comp. ROSENVINGE, l. c. p. 78) I may add that the plant in the West Indies was found in quite salt water.

Found upon *Liagora elongata* at Long Point, St. Croix.

Geogr. Distrib. Atlantic coast of Europe, Mediterranean Sea, North America.

Goniotrichum Kütz.

1. Goniotrichum elegans (Chauv.) Le Jolis.

LE JOLIS, Alg. mar. Cherb., p. 103. BERTHOLD, Bangiaceæ, p. 26. HAUCK, Meeresalgen, p. 518. ROSENVINGE, Marine Alg. of Denmark, part I, p. 75.

Bangia elegans Chauvin, Alg. Norm. no. 159; Mém. Soc. Linn. Norm., t. 6, 1838 (not seen), id., Recherches . . d'Algues, Caen. 1842, p. 33. HARVEY, Phyc. Brit., pl. 246.

Bangia Alsidii Zanard., Bibl. Ital., t. 96, 1889 (not seen); id., Synopsis Alg. mar. Adriat. (Memorie d. r. Accademia d. Scienze di Torino, Serie II, Tomo IV, 1842, p. 217, tab. VI, fig. 7).

Goniotrichum Alsidii (Zanard.) Howe, The marine Algæ of Peru (Memoirs of the Torrey Botanical Club, vol. XV, 1914, p. 75 [1]).

The specimens found reached a length of about 1 mm.; at their base they were about 25—35 μ thick, at the summit only about 15 μ.

They are fixed to the substratum by means of a small disc formed by the basal cell (Fig. 2 *c*).

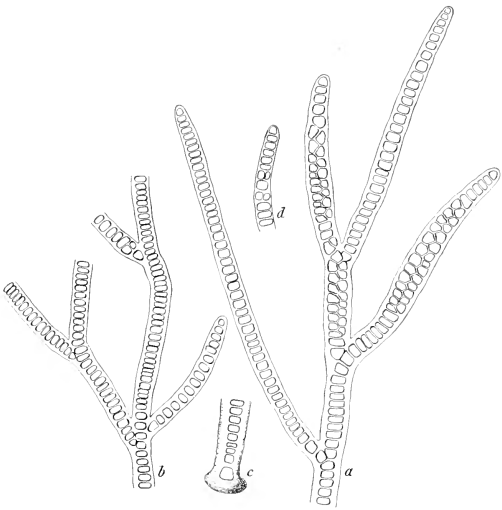

Fig. 2. *Goniotrichum elegans* (Chauv.) Le Jolis.
a and *b*, parts of the thallus showing ramification. *c*, base of a plant. *d*, summit of plant with longitudinally divided cells. (About 150 : 1).

The filaments (Fig. 2 *a* and *b*) consist for the most part of a single row of cells and in some specimens these were almost the only ones which occurred, but several specimens had filaments which more or less consisted of 2—3 or even 4 cells in transverse section. The cells in these filaments are irregularly arranged,

[1]) The reason I do not follow Dr. Howe in using Zanardini's name for this species is because it seems impossible judging from Zanardini's description and figure to say quite certainly which species of *Goniotrichum* we have to do with.

occurring in irregular rows. These specimens certainly approach the form described by BERTHOLD in his "Bangiaceæ" p. 26 as *Goniotrichum dichotomum* and found in the Gulf of Naples, but he found up to eight cells in a cross section of the thallus while, as mentioned above, I found 2—4 only. HAUCK refers BERTHOLD's plant to *Goniotrichum Cornu* Cervi (Reinsch) Hauck[1]) but in this species there are many more cells together in the filaments at the same level.

My plant evidently comes very near to the form from the coast of Peru mentioned by HOWE l. c.

In the specimens from the Danish waters which are figured and described by ROSENVINGE we find now and then more than a single cell at the same level. According to ROSENVINGE's statement this was caused in the specimens examined by him not by longitudinal walls but by displacement of the cells. In addition to this way of obtaining several cells in the filaments the multiplication of the cells in my plants is certainly also due to longitudinal division of the cells (comp. fig. 2 *d*).

The cells contain a starlike chromatophore with a central pyrenoid. In the filaments consisting of a single row of cells these are mostly short, often only a fourth part of their diameter; the most common is that about half their length, more rarely they are about as long as broad. The diameter of the cells is about 12 μ.

In the filaments on the other hand consisting of several cells these are most often about as long as broad and by mutual pressure of irregular polygonal shape.

The ramification is described in detail by ROSENVINGE; it reminds one as is well-known of the so-named false branching of the *Scytonemataceæ*.

Concerning the reproduction ROSENVINGE has not made any observation and I have not succeeded in finding anything in my material.

The plant is found partly upon other algæ partly upon different substrata e. g. old pieces of tree etc. It seems to be a common plant at the islands.

St. Thomas: French Wharf. St. Jan: Near America Hill. St. Croix: Christianssted, Lt. Princess, Frederiksstel and other places.

Geogr. Distrib. Europe, Mediterranean Sea, Maroc, Peru.

[1]) HAUCK, F., Meeresalgen, p. 17. This species was first described by REINSCH in "Contributiones", vol. I, 1875, p. 40, pl. XV and here called *Stylonema Cornu Cervi*.

Subfam. 2. Erythrotrichieæ.

Erythrotrichia Areschoug.

1. Erythrotrichia carnea (Dillw.) J. Ag.

J. Agardh, Till Algernes Systematik, VI, Ulvaceæ (Lunds Univ. Års-skrift, t. XIX, 1883, p. 15. Rosenvinge, Mar. Algæ of Denmark, part I, 1909, p. 67.

Conferva carnea Dillwyn, British Conferv., 1809, pl. 84.

Conferva ceramicola Lyngb., Hydrophytol. 1819, p. 144, pl. 48 D.

Bangia ceramicola Chauvin, Recherches sur l'org. . . . d'Algues, Caen 1842, pag. 29—30; Harvey, Phycol. Brit., pl. 317.

Erythrotrichia ceramicola Aresch., Phyc. Scandinav. 1850, p. 210; Le Jolis, Alg. mar. Cherb., 1880, p. 103, pl. 3, fig. 1—2; Berthold, Bangiaceæ, 1882, p. 25.

The plant is, as mentioned and figured by Rosenvinge, fastened to the substratum by the basal cell which forms an irregularly lobed disc often with ramified rhizines radiating from it.

The length of the vegetative cells is rather variable; most often the length is shorter than the breadth, but cells longer than broad occur. The cells contain a starlike chromatophore with a large pyrenoid and a small nucleus not always easy to find as it is often, as pointed out by Rosenvinge, hidden behind the chromatophore.

The reproductive cells are commonly somewhat longer than the breadth, the sporangium was of about the same size as the sister cell or somewhat smaller.

It has been gathered in the months December—March and was in fruit it that time.

It occurs epiphytically upon larger algæ, e. g. *Sargassum*, *Acanthophora* etc. and seems to be rather common.

Geogr. Distrib. Atlantic coast of Europe and North America, Mediterranean Sea, Maroc, West coast of North America etc.

Erythrocladia Rosenv.

1. Erythrocladia subintegra Rosenv.

Rosenvinge, L. Kolderup, The marine Algæ of Denmark, Part I, København 1909, p. 73.

This plant was found epiphytic (Fig. 3 *d*)[1]) upon specimens of *Chætomorpha* and *Cladophora* upon which it forms small roundish

[1]) In contradiction to the statement of Rosenvinge, Howe (in "The marine Algæ of Peru", p. 82) is of the opinion that it is ordinarily immersed in the wall of the host and that it is "endophytic rather than epiphytic".

or more irregularly shaped discs up to 300 μ in diameter or even more. The young specimens have a nearly circular or somewhat undulate continuous margin (Fig. 3, *a* and *b*), in older specimens it is more irregular and the extremeties of the filaments become

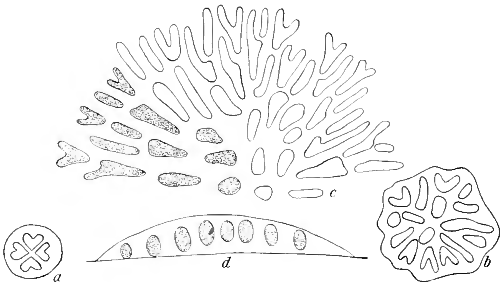

Fig. 3. *Erythrocladia subintegra* Rosenv.
a, *b*, young plants seen from above. *c*, older plants with more irregular margin. *d*, transverse section of the thallus. (About 700 : 1).

more or less free (Fig. 3 *c*). It has marginal growth and, as pointed out by ROSENVINGE, the cells are dichotomously divided but the bifurcation is most often not quite equal, the one cell being larger than the other. Near the margin the cells are often linear-oblong or forked, in the middle shorter, oblong, or of more irregular shape.

Fig. 4. *Erythrocladia subintegra* Rosenv. Part of a plant seen from above. In some of the cells sporangia are cut off. (About 700 : 1).

The diameter of the cells is mostly 3—4 μ but it is very variable and so also the length which often reaches up to 16 μ or more.

The chromatophore was not clearly visible but it seems to be parietal with a pyrenoid in the middle of the cell.

The sporangia (Fig. 4) are as said by ROSENVINGE cut off in the ends of the vegetative cells through a somewhat curved wall; they are of variable shape and size, mostly roundish orbicular and about 3—4 μ broad.

In referring this plant to the genus *Erythrocladia* I confess that it is not without doubt. According to ROSENVINGE l. c. p. 72

the thallus of this genus "consists of mutually separate filaments which only at a later stage are partly confluent"; this corresponds with *Erythrocladia irregularis* but how far it does with *Erythrocladia subintegra* seems more doubtful. Rosenvinge has not found young specimens of his plant but such occurred often in my material and as pointed out above the young specimens have a continuous margin with no free ends; in the older specimens, on the other hand, with more irregular margin free ends are present. These older specimens agree very well with the figures 13 and 14 of Rosenvinge and also with specimens in a preparation which he has most kindly allowed me to examine. Dr. Rosenvinge discusses the possibility as to how far this species ought to be referred to the genus *Erythropeltis* Schmitz [1]) but as pointed out by him such a comparison is difficult to undertake as *Erythropeltis* is imperfectly known. In my opinion this genus of Schmitz is very problematic as is also pointed out by Howe [2]): "Schmitz, in proposing the new generic name *Erythropeltis* for *Erythrotrichia discigera* Berthold (which he cites as the monotype of his new genus without any pro parte reservations), omits any reference to the erect filaments described and figured by Berthold". Erect filaments have not been found neither in Rosenvinge's nor in my plant. On account of these facts it seems to me not impossible that this species ougth to be regarded as a representative for a new genus.

Yet I want to point out that my plant seems to show much likeness to the discs found in the newly described *Erythrotrichia polymorpha* Howe [3]) and especially to those forms found upon *Chætomorpha cartilaginea* and *Cladophora fascicularis* in which the erect filaments often are wanting. If we compare my figures (Fig. 3 *a* and *b*) with e. g. figs. 5, 7 and 9 of Howe it cannot be denied that the similarity is striking, But the cells and sporangia are larger in Howe's plant, the disc is distromatic in the middle and erect filaments are also present.

St. Thomas: In the Harbour, St. Croix: Northside Estate.
Geogr. Distrib. Danish waters. Most probably widely spread.

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[1]) In Engler & Prantl, "Nat. Pflanzenfam." I, Abt. 2, p. 313, 1896.
[2]) Howe, M. A., l. c., p. 80.
[3]) Howe, M. A., l. c., p. 77.

Subfam. 3. **Bangieæ.**

Bangiopsis Schmitz.

1. **Bangiopsis subsimplex** (Mont.) Schmitz.

Schmitz in Engler und Prantl, Natürl. Pflanzenfam., 1. Teil, 2. Abt., p. 314.

Compsopogon subsimplex Montagne in Annales scienc. nat., Bot., III^e sér., t. 14, 1850, p. 299.

When young the plant is filamentous composed of a single row of cells. These in the young filaments are disc-shaped (Fig. 5 *c*), their length being much shorter than the breadth, often only a fourth in the newly divided cells. They are divided by horizontal walls and all cells are capable of division. The diameter of the filaments is about 35 μ. The base of the plant consists of an enlargement of the lowermost end of the basal cell, forming in this way a small disc by means of which the plant is fastened to the substratum (Fig. 5 *h*). I have not seen any rhizoids growing out from the lowermost cells as is the case in *Bangia*.

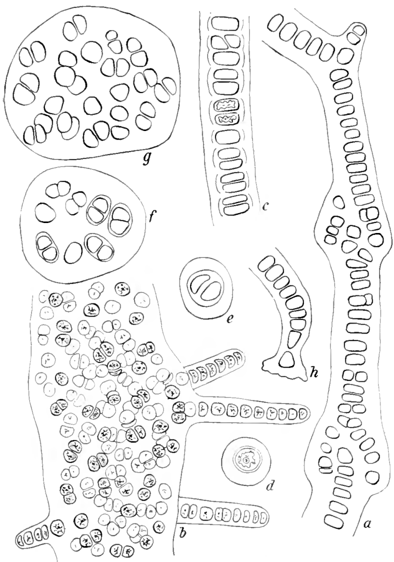

Fig. 5. *Bangiopsis subsimplex* (Mont.) Schmitz. *a*, part of a filament which begin to be ramified. *b*, part of a ramified thallus. *c*, filament composed of a single row of cells showing cell-division, in the upper end one cell divided by an oblique wall. *d*, *e*, *f*, *g*, transverse sections of filaments consisting of a single to many cells. *h*, base of a plant. (*a* and *b* about 150 : 1, *c—h*, 200 : 1).

In the somewhat older filaments the cells now and then begin to be divided also by longitudinal or more or less oblique walls. This division of the cells is rather irregular; in some plants nearly the whole filaments are divided, in other we find parts of the filaments divided into many

cells and between these there are thinner parts still consisting of a single row of cells (Fig. 5 *a*).

Figs. 5 *d*, *e*, *f*, *g* show transverse sections of filaments in different stages of development; fig. 5 *d* is of a filament still consisting of a single row of cells, in fig. 5 *e* we find two cells and in fig. 5 *f* and *g* several. As the figures show the cells lie scattered without order in the whole filament. In this my plant differs essentially from the description of SCHMITZ (l. c.) where the thallus is said to be: "der ganzen Länge nach röhrig hohl, mit gallertgefülltem Hohlräume".

Now and then especially from the thicker parts of the filaments branches grow out; these are commonly short, proliferation-like, consisting of a single row of cells (Fig. 5 *b*, Fig. 6); only rarely I have found them longer and more like the main filaments.

Each cell contains a starlike red-violet chromatophore in the middle of which a large pyrenoid is present (Fig. 6).

In some filaments all or nearly all cells were emptied, the few remaining cells were nearly spherical and with a granulated contents. I take these cells for the gonidia. I have not succeeded in finding other kind of organs of propagation.

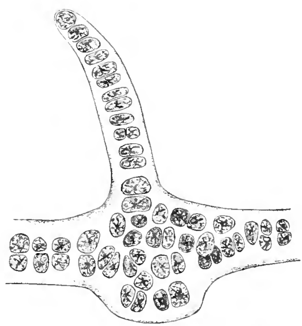

Fig. 6. *Bangiopsis subsimplex* (Mont.) Schmitz. Part of a thallus showing cells with chromatophores and pyrenoids. (About 250 : 1).

While my plant seems to agree quite well with the description of MONTAGNE it differs as pointed out above from that of SCHMITZ's by its solid thallus. MONTAGNE referred the plant to the genus *Compsopogon*, while SCHMITZ created for it the genus *Bangiopsis*. It comes surely near to *Bangia* but differs essentially from this genus by the want of rhizines at the base and by the common presence of proliferations and especially by the rather irregular cell-division, the cells in *Bangia* being divided by radial walls and these as a result are generally wedge-shaped.

The plant has been found only once growing upon a buoy in the harbour of Christianssted, St. Croix.

Geogr. Distrib. Guiana.

B. Florideæ.

I. Nemalionales.

Fam. 1. ***Helminthocladiaceæ.***

Subfam. 1. Chantransieæ.

Acrochætium Nägl.

After an exhaustive enquiry as to the correct generic name for the plants hitherto usually grouped under *Chantransia* I have come to the conclusion, in agreement with the opinion, amongst others, of J. Agardh[1]), Batters[2]) and quite recently M. A. Howe[3]) that we must adopt Nägeli's name *Acrochætium*[4]).

I will shortly give my reasons for this.

The genus *Chantransia* was originally created by De Candolle[5]) but, as pointed out by Thuret[6]), his genus includes forms of genera as different as *Lemanea, Batrachospermum, Cladophora* and *Oedogonium* and has therefore nothing to do with the genus *Chantransia* as now understood.

It was first Fries[7]) who in 1825 reorganized it more precisely giving as types of the genus the two freshwater forms *Conferva Hermanni* and *Conferva chalybæa* Roth.

But before this Bory[8]) had already referred these plants to his new genus *Audouinella*. From this fact alone the genus *Chantransia* Fries ought to be regarded as a synonym when the priority is strictly followed. But the position of this genus became yet more untenable when it was discovered by Sirodot[9])

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1) Agardh, J., Analecta Algologica, Lundæ 1892, p. 45.

2) Batters, E. A. L., A Catalogue of the British marine Algæ (Journ. of Bot., Supplem. 1902, p. 58).

3) Howe, M. A., The Algæ of Peru (Memoirs of the Torrey Bot. Club, vol. XV, New York 1914, p. 63).

4) Nägeli, Beiträge zur Morphologie und Systematik der Ceramiaceæ. (Sitzungsb. Königl. Bayer. Akademie der Wissensch., 1861, p. 402).

5) Lamarck et De Candolle, Flore Française, t. II, 1805, p. 49.

6) Thuret in Le Jolis, Liste des Algues de Cherbourg, 1864, p. 104.

7) Fries, E., Systema orbis vegetabilis, Pars I, p. 338, Lundæ 1825.

8) Bory de Saint-Vincent in "Dictionnaire classique d'histoire naturelle", t. 3, Paris 1823, p. 340.

9) Sirodot, S., Les Batrachospermes. Paris 1884.

and later by other investigators[1]) that the freshwater *Chantransiæ* were only stages in development of *Batrachospermum* etc.[2]).

Nägeli published his genus *Acrochætium* in 1861. It was based upon several marine forms known at that time. But in those days the freshwater *Chantransia* were considered as independent species, and these are, as is well known, so much like the marine ones that Nägeli ought to have referred the marine species to this genus as Thuret did some few years after. Had Nägeli done so, we should not perhaps have been obliged to give up this old generic name.

Yet it should be born in mind that Schmitz[3]) in 1889 reformed the genus *Chantransia* in a somewhat different sense to Thuret namely without including the freshwater *Chantransia* and in his sense therefore the genus equals *Acrochætium*.

Owing to these facts it seems to me necessary to adopt Nägeli's name. In connection with this I will transcribe Batters' conclusion as to this question. In his paper quoted above he writes p. 58: "Under these circumstances it seems to me that either the name *Audouinella* must be substituted for *Chantransia* as that genus was understood by Thuret (i. e. to include both freshwater forms, like *C. chalybea* and *C. Hermanni*, and marine, like *C. corymbifera*, *C. efflorescens*, and *C. microscopica*), or, as seems preferable, to preserve the former name as that of a doubtful genus of freshwater algæ, and to adopt Nägeli's genus *Acrochætium* for the reception of the well-understood marine forms".

In 1904 Bornet[4]) proposed to separate the species with sexual reproduction from those bearing only sporangia the first ones to be kept in the genus *Chantransia* the others to be referred to the genus *Acrochætium*. I quite agree with Rosenvinge that this distinction seems very artificial and in the following survey of the species found in the Danish West Indies I follow him and refer all the species to the same genus.

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[1]) Comp. De Toni, Sylloge Alg., vol. IV, Sectio IV, p. 1863, the note.

[2]) Here I may call attention to the fact that Brand (in his paper: Über die Süsswasserformen von Chantransia (D. C.) Schmitz einschliesslich Pseudochantransia Brand, "Hedwigia" vol. 49) has pointed out that besides the *Chantransia*-like forms of *Batrachospermum* etc. there are also some independent species of *Chantransia* and among these *Ch. Hermanni*. This certainly needs further investigation.

[3]) Schmitz, Fr., Systematische Übersicht der bisher bekannten Gattungen der Florideen ("Flora", 1889).

[4]) Bornet, E., Deux Chantransia corymbifera Thuret. Acrochætium et *Chantransia* (Bull. Soc. bot. de France, T. 51, Paris 1904).

In this connection, however, I may remark that in nearly all the species mentioned below I have looked in vain for sexual organs; only in a single species, *Acroch. Sargassi*, were they found.

Neither did tetrasporangia occur in the West Indian species collected by me; on the other hand I have previously described a species *Acrochætium* (*Chantransia*) *bisporum* in which sporangia divided by a cross wall into two spores were common and in another species, *Acrochætium occidentale*, described below some few sporangia divided in the same way were met with.

In the above-mentioned paper by Bornet the eminent phycologist has pointed out that the development and structure of the basal part of the thallus is of great systematic value in a genus consisting of such small plants and, as to the vegetative and reproductive parts of the thallus, often so very similar. In his excellent treatment of the Danish species Rosenvinge also has largely based his differentiation and classification of the species on the method of development of the basal portion.

In the West Indian material likewise it has been evident that excellent characters may be found in the base of the thallus and I have succeeded in finding not only most of the types mentioned by Rosenvinge but also others coming near to some mentioned by Bornet. It has, however, not always been an easy matter to follow the development of the germinating spore. When several species grow together this is most often impossible; upon the leaves of an old *Sargassum vulgare* was found at least six different species and here it was very difficult to clear up the structure of the basal part, and its development from the germinating spore was quite out of the question. Of one species mentioned below I have only succeded in finding a single specimen and have not been able with certainty to state the structure of the base; but as the plant had a very characteristic appearance I think it is entitled to a description.

When speaking of the basal part I wish also to point out that there are many connecting links from the epiphytic to the endophytic species. In *Acrochætium crassipes* the lowermost part is, when growing upon a plant of soft surface, often somewhat immersed; on the other hand when growing upon the spines of *Centroceras* it seems not immersed at all.

Upon *Avrainvillea nigricans* was found an *Acrochætium* (*A. Avrainvilleæ*) whose base, composed of short creeping filaments, was fixed to filaments rather deeply sunk in the tissue of the host plant. The tissue of *A. nigricans* is very loose and open

and the erect filaments of the *Acrochætium* have not much difficulty in immerging from it. From this stage of endophytism, if such it ought be called, there is an even transition to those species (as *Acrochætium occidentale* and *Acr. comptum*) fixed to the assimilating filaments of *Liagora*. The space between the filaments of the species belonging to this genus is filled with mucilage and also with more or less of a chalk incrustation. The basal filaments of the above mentioned *Acrochætium* species creep epiphytically upon the filaments of the host plant, but they are on the other hand immersed in the mucilage. Quite immersed in this mucilage is *Acrochætium Liagoræ*.

In other species again the endophytic filaments are able to penetrate more or less into the cellular tissue of the host plant. Here also graditions may be observed. In some species e. g. *Acrochætium robustum*, *unipes* and others only short endophytic processes are present. In *Acrochætium hormorhizum* the basal part is immersed in the thick wall of the host plant. *Acrochætium repens* has endophytic filaments creeping extensively in the tissue of the host plant sending up here and there erect free filaments.

Further as pointed out by KYLIN and later by ROSENVINGE the shape of the chromatophore is of great systematic importance. Referring for details to ROSENVINGE's description I will here only mention that by far the greatest number of the West Indian species have a parietal more or less lobed chromatophore with a lateral excentric pyrenoid protruding more or less into the lumen of the cell. In other species a stellate chromatophore with a central pyrenoid is found.

The following classification of the species is based essentially upon the different development of the basal part, next upon the shape of the chromatophore and other characters.

Key to the West Indian species of Acrochætium.

A. Epiphytes.
- a. A single undivided basal cell.
  - 1. With sex-organs, chromatophore parietal . . . . . . 1. *A. Sargassi.*
  - 2. Without sex-organs, chromatophore stellate . . . . 2. *A. crassipes.*
- b. The germinating spore is divided into two cells . . . 3. *A. pulchellum.*
- c. Basal layer multicellular, composed of creeping filaments fusing more or less together.

1. Erect filaments about 5—6 μ thick.
   α. Sporangia sessile or pedicellate, fusiform . . . . 4. *A. netrocarpum.*
   β. Sporangia sessile or pedicellate or several together upon short branchlets, oblong-linear . . 5. *A. gracile.*
   γ. Branchlets mostly opposite with mostly several sporangia . . . . 6. *A. globosum.*
2. Erect filaments about 8—10 μ thick.
   α. Cells proportionally short, mostly barrel-shaped, hairs present . . . . 7. *A. Sancti Thomæ.*
   β. Cells cylindric, hairs wanting.
      aa. Sporangia seriate, mostly sessile, sometimes pedicellate . . . . 8. *A. seriatum.*
      bb. Sporangia mostly placed 1—2 upon branchlets . . . . 9. *A. flexuosum.*

B. The base of the plant partly endophytic.
   a. Germinating spore persistent at the base of the plant.
      α. Spore with a single endophytic, obovate or subclavate, descending process . . . . 10. *A. unipes.*
      β. Spore with a cuneate process and, sometimes, with short epiphytic horizontal branches 11. *A. opetigenum.*
   b. Epiphytic basal disc with endophytic process 12. *A. robustum.*
   c. Epiphytic and endophytic filaments . . . 13. *A. bisporum.*

C. The whole base of the plant endophytic.
   a. The germinating spore persistent and easily recognizable.
      1. The spore remains undivided . . . . . 14. *A. occidentale.*
      2. The germinating spore is divided into two cells . . 15. *A. comptum.*
   b The original spore not recognizable.
      1. Base composed of more or less horizontal creeping filaments.
         α. The base immersed in the loose tissue of the host plant . . . . 16. *A. Avrainvilleæ.*
         β. The base immersed in the thick wall of the host plant; endophytic filaments moniliform . . 17. *A. hormorhizum.*
         γ. The endophytic filaments immersed in the wall and between the cells of the host . . 18. *A. Hypneæ.*
         δ. The endophytic filaments widely spread in the tissue of the host . . . . 19. *A. repens.*

2. A multicellular vertical basal layer 20. *A. phacelorhizum.*
D. The whole plant immersed in the host plant . 21. *A. Liagoræ.*

In addition is described below *A. ernothrix* the base of which I have not succeeded in seeing clearly.

1. **Acrochætium Sargassi** nov. spec.

Thallus usque ad 700 μ altus. E cellula basali, discum parvum formante, filum erectum, a basi ramosum, egreditur.

Rami sparsi aut secundati aut oppositi, simplices aut ramosi, ad apicem versus attenuati, in pseudopila sæpe producti, ex cellulis in parte inferiori thalli 5,5 μ latis, 9—18 μ longis, in superiori parte 2—3 μ latis, 30—40 μ longis compositi.

Chromatophorum parietale, pyrenoide laterali instructum.

Sporangia sparsa aut pauca secundata, in ramulis sæpe bina præsentia, sessilia aut pedicellata, obovata, 10 μ longa, 7 μ lata. Antheridia in ramulis opposita aut plus minus irregulariter aggregata, globularia, ca. 2 μ lata; carpogonia lageniformia, sessilia.

This plant reaches a length of up to 600—700 μ. The base (Figs. 7 and 8 *a*) consists of a flat disc (about 20 μ diameter) formed by the original spore and apparently in a similar way to that found in *Acrochætium* (*Chantransia*) *microscopicum* Nægl. var. *collopoda* ROSENVINGE, described and figured by ROSENVINGE in "Deuxième Mémoire sur les Algues mar. du Groenland" (Meddelelser om Grønland, XX, p. 412). By means of this small disc the plant is fixed firmly to the host plant (old leaves of *Sargassum vulgare*).

From this disc is given off a single filament which immediately begins to branch (Fig. 7). The cells in the lowermost part of the filaments are short and have thick walls; they are about 9 μ long and 5,5 μ broad, in vigorous plants up to 8 μ broad. Higher up the cells grow longer, up to about 18 μ, tapering at the same time, and the filaments end with long, thin nearly colourless, hairlike prolongations which soon die away; in these the cells are only 2—3 μ broad while their length is about 30—40 μ or more. ROSENVINGE also found such discoloured prolongations in several species and compared them with the hair-like organs in the *Phæophyceæ.*

The filaments are as a rule very stiff and straight and arise from the principal filaments, often serially, sometimes

Fig. 7. *Acrochætium Sargassi* nov. spec.
Habit of a plant with monosporangia and antheridia. (About 180 : 1).

scattered, and now and then opposite (Fig. 7). The branches are similarly ramified and run out into long hair-like organs.

The chromatophore is usually slightly developed (Figs. 9 and 10); it is parietal often with some long irregularly shaped prolongations; in some of the cells it often consists only of a small portion surrounding the pyrenoid and lying at the wall of the cell.

Fig. 8. *Acrochætium Sargassi* nov. spec. *a*, plant with sporangia. *b*, part of a filament with sporangia. *c*, part of a plant with carpogonia. (*a*, about 100 : 1, *b*, 500 : 1, *c*, 400 : 1).

The sporangia are found either at the base of the filaments upon their upper side sometimes solitary, sometimes two or three together, or they may occur upon short branchlets given off from the principal filaments. They are mostly pedicellate but sessile ones also occur. The sporangia are oval-obovate (Fig. 8 *b*, 9); their length is about 10μ, their breadth about 7μ.

This is the only West Indian species in which sexual organs were found. Specimens with antheridia were seen several times (Fig. 7). The antheridia occurred in pairs along both sides of the small fertile branchlets (Fig. 10) but were now and then more irregularly arranged.

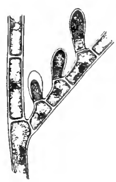

Fig. 9. *Acrochætium Sargassi* nov. spec. Part of the thallus with sporangia. The nethermost has been emptied and a new one is growing out again. (about 600: 1).

For a long time I searched vainly for the carpogonia and finally I succeded in finding a specimen in which some few carpogonia undoubtedly were present. As Fig. 8 *c* shows they are bottle-shaped having nearly the same form as in other species. No later stages of carpogonia were found.

This plant seems to come very near to *Acrochætium Dufourii* Collins and I have been in great doubt how far that plant is indeed only a young state of my species. But after having examined the original material of *Acroch. Dufourii*, distributed in "Phyc. Bor.-Am.", No. 1594 I think it is not.

A general difference must be pointed out in the fact that *Acrochæt. Dufourii* seems to be somewhat smaller in all parts of its thallus.

The base in both plants appears to be very alike; in both it is a somewhat flat, upwards convex, below nearly plane disc, formed by secretion of the basal cell; it is smaller in *Acr. Dufourii* than that found in my plant, but in one specimen it reached a diameter of about 14 μ. In *Acr. Dufourii* the erect filaments are about 4—5 μ broad, in my plant the filaments at their base are mostly 5—6 but specimens occur in which the filaments are 8 μ thick. But while, and this is the most essential difference, the plant of Mr. Collins does not taper towards its summit the filaments in my plant taper very much and run out in thin nearly colourless hair-like prolongations. This is not mentioned in the description of Collins and I have not been able to find any trace of this in the dried specimen in "Phycotheca". Besides, as is evident from the above description, my plant is much more branched and generally more developed (e. g. with sex organs) than *Acr. Dufourii*.

Fig. 10. *Acrochætium Sargassi* nov. spec. Branch with branchlets bearing antheridia. (About 600 : 1).

This species occurred together with several other upon old leaves of *Sargassum vulgare*.

St. Thomas: The Harbour.

2. Acrochætium crassipes Børgs.

Børgesen, F., Some new or little known West Indian Florideæ, I. (Botanisk Tidsskrift, vol. 30, 1909, p. 1).

var. *typica* nov. var.

Børgesen, F., l. c.

My previous description of this plant was based upon few specimens only; now by renewed efforts I have been fortunate enough to find it in other collections and this enables me to give some additions to my former description.

The basal cell is subcylindric-barrelshaped with thick walls (Fig. 11 *A*, *B*); in my former description I said that it was fastened to the surface of the host plant by means of a rather thick layer of cementing substance and this is also the case where it is growing e. g. on the spines of *Centroceras* as shown in the fig. 11 *A* and *B*, but when found upon a more soft substratum e. g. upon *Hypnea* it sometimes, at any rate, is somewhat im-

mersed with the basal part in the wall of the host plant, in agreement with M. A. HOWE's description of *Acrochætium catenulatum*[1]).

The basal cell bears as a rule one or two erect filaments which most often are more or less curved and decumbent and graduallly taper towards their summits, the basal cell being the thickest of all.

Hairs seldom occur; most of the plants are quite destitute of them. Where they are present they are always to be found at the tips of the filaments (Fig. 11 *B*).

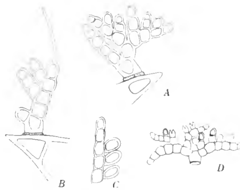

Fig. 11. *Acrochætium crassipes* var. *typica*. *A* and *B*, two plants growing on *Centroceras*; *B*, with a hair (300 : 1). *C*, piece of a branch with monosporangia (300 : 1). *D*, plant with monosporangia and emptied ones (150 : 1).

The chromatophore is stellate with a central pyrenoid. In most of the cells plenty of starch is present and the contents of the cells then have a quite homogenous appearance; but when boiled and coloured e. g. by means of hæmalun the stellate chromatophore is easily seen.

Fig. 12. *Acrochætium crassipes* Børgs. var. *longiseta* nov. var. Plant with a single sporangium and hairs, in the cells the stellate chromatophore with the central pyrenoid. (about 800 : 1).

var. *longiseta* nov. var.

Upon specimens of *Chætomorpha antennina* from the harbour of St. Thomas and on *Chætomorpha brachygona* from Christianssted was found abundantly a small *Acrochætium* which shows so much likeness to *Acrochætium crassipes* that I have no doubt in referring it to this species from which it essentially differs by the usual presence of long hairs.

The basal cell originating from the germinating spore is, as is the case in var. *typica*, the largest of the whole plant (Fig. 12), being 8—10 μ in diameter. It is fixed to the host plant by means of a ring of cementing substance and, so far as I have been able to see, it is also often somewhat immersed in the wall of the host (Fig. 12, 13 *e*). From the basal cell arise a single or 2—3 suberect branches, the cells of which grow gradually thinner and at the same time longer towards

[1]) M. A. HOWE, The marine Algæ of Peru ("Memoirs of the Torrey Botanical Club", vol. XV, 1914, p. 84).

the summit where their diameter is only about 4—5 μ while the length of the cell is about 6—7 μ. The basal cell and the lowermost cells in the filaments are about as long as broad, often even a little shorter than broad.

The principal filaments are as in the var. *typica* mostly very curved (Fig. 13 *a*, *c*); along the upward side of the filaments all the cells may bear sporangia, or in the more vigorous plants short branchlets; more rarely some of the cells are provided with branches on the opposite side (Fig. 13 *c*).

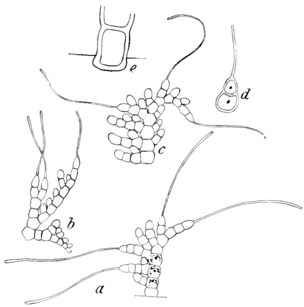

Fig. 13. *Acrochætium crassipes* Børgs. var. *longiseta* nov. var. *a*, *b*, *c*, habit of plants. *d*, a young plant. *e*, base of a plant showing the immersed nethermost part. (*a*, *b*, *c*, about 250 : 1; *d*, *e*, about 800 : 1).

The cells contain a stellate chromatophore with a central pyrenoid (Fig. 12) quite in accordance with that found in the var. *typica*.

At the ends of the filaments long hyaline hairs occur (Figs. 12, 13), these are about 1—2 μ thick and reach a length of about 50 μ.

The sporangia are always monosporous; they are oval-obovate, about 5 μ broad and 6—7 μ long. They are mostly sessile, but sometimes also pedicellate or placed upon short branchlets; now and then such branchlets have two sporangia.

The length of the larger specimens without hairs is about 60 μ.

This species seems to be nearly related to *Acrochætium* (*Chantransia*) *moniliforme* Rosenvinge and *Acrochætium catenulatum* Howe. From the first mentioned species it differs essentially in its smaller size in every respect, and by the proportionally larger basal cell. And *Acrochætium catenulatum* differs from our plant among other things by its larger size, want of hairs and apparently different chromatophore.

This species has been found upon different host plants, namely, *Hypnea*, *Centroceras*, *Bryopsis*, *Chætomorpha*, *Cladophora* etc. It seems to be a common species especially in more sheltered places.

Var. *typica* has been found at St. Thomas: in the Harbour and in Magens Bay, at St. Jan: in Cruz Bay and at St. Croix: near Christianssted.

Var. *longiseta*. St. Thomas: in the Harbour and at Water Island; St. Croix: at Christianssted.

3. Acrochætium pulchellum nov. spec.

Thallus minutus, pulvinatus. Pars basalis e filis repentibus ramosis, in parte centrali sensim confluentibus, composita. Spora germinans in duas cellulas fere æquales divisa est, quarum utraque filum ramosum repens procreat.

Cellulæ in parte basali irregulares, breves, 7—10 μ longæ et 5—6 μ latæ. Ex his cellulis fila erecta brevia, 1—3 raro plures cellulas continentia, ca. 24 μ alta, egrediuntur; cellulæ 5—6 μ latæ, diametro $1^1/_2$—2-plo longiores, chromatophorum stellare pyrenoide centrali instructum continentes. Pili hyalini terminales, ca. 100 μ longi, 2—3 μ lati, numerosi.

Sporangia in filis erectis terminalia, raro in filamentis repentibus sessilia, ovata, 5—7 μ lata et 9—10 μ longa.

Of the species described by ROSENVINGE the present plant seems to come nearest to *Acr. (Chr.) humile*; in its mode of growth and the structure of the cells it also somewhat resembles *A. (C.) polyblastum* Rosenv. but the erect filaments are not so large.

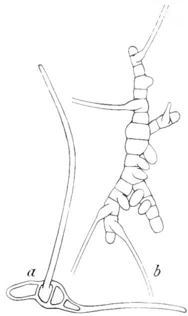

Fig. 14. *Acrochætium pulchellum* nov. spec. Young plants in which the original spores, divided into two cells, are yet visible. (About 600 : 1).

In agreement with the above mentioned species the germinating spores are divided into two nearly equal cells (Fig. 14); in the young plants these cells are easily recognizable, in the older they are most often not. From each of these cells a creeping filament is given off in opposite directions; these filaments soon begin to branch, the branches in the middle fusing more or less together. By this method of growing a relatively large disc may be formed (Fig. 15). The cells are rather irregularly shaped with more or less sinuated walls, short, about 5—6 μ broad and 7—10 μ long.

From the cells in the basal layer short erect filaments consisting of 1—3 seldom more cells arise. These filaments are terminated by long hyaline hairs or they may bear the sporangia (Fig. 15). Hairs also occur at the ends of the creeping filaments but are soon pushed aside. The hairs reach a length of 100 μ or more and 2—3 μ broad. They are, as mentioned above, hyaline; the young hairs are richly provided with protoplasm.

The chromatophore is stellate with a central pyrenoid (Figs. 15 and 16).

The erect filaments reach 24 μ and occasionally higher; their breadth is about 5—6 μ.

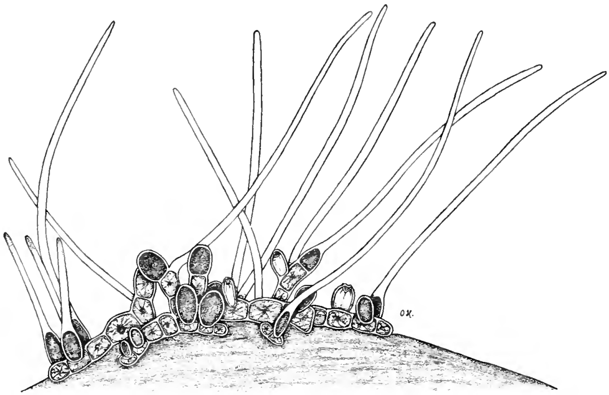

Fig. 15. *Acrochætium pulchellum* nov. spec.
Plant with monosporangia of which someones are emptied; it creeps upon *Chætomorpha*. (About 700 : 1).

The sporangia are mostly terminally placed upon the erect filaments; more rarely sessile sporangia, placed immediately upon the cells of the basal filaments are found. The sporangia are ovate, about 5—7 μ broad and 9—10 μ long.

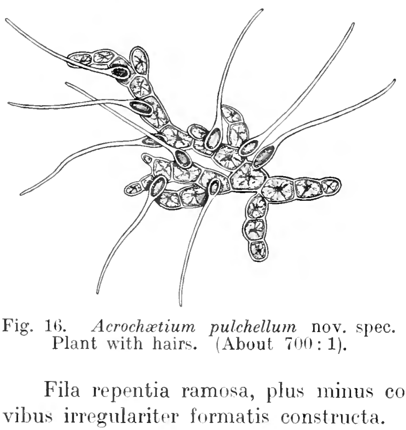

Fig. 16. *Acrochætium pulchellum* nov. spec.
Plant with hairs. (About 700 : 1).

This species has been found upon *Chætomorpha antennina* in a very exposed place on rocky coast.

St. Croix: Northside.

4. Acrochætium netrocarpum nov. spec.

Thallus cæspitosus ad 400 μ altus, e filis repentibus et filis erectis numerosis compositus.

Fila repentia ramosa, plus minus confluentia ex cellulis brevibus irregulariter formatis constructa.

Fila erecta parce ramosa, 5—6 μ lata, cellulis diametro triplo vel 4 plo longioribus, cylindricis, in parte superiori filorum cellulis tenuioribus, 3—4 μ latis, chromatophorum, ut videtur, parietale pyrenoide laterali munitum continentibus.

Sporangia monospora, fusiformia apice truncato, sessilia aut pedicellata, sparsa aut unilateraliter seriata, 4—5 μ lata, 10—11 μ longa.

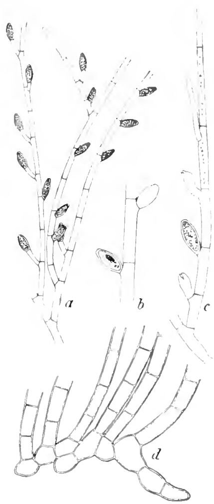

Fig. 17. *Acrochætium netrocarpum* nov. spec. *a*, *b*, *c*, parts of filaments with sporangia. *d*, base of the plant. (*a*, 300 : 1; *b*, *c*, 450 : 1; *d*, 600 : 1).

This small species was found upon old leaves of *Caulerpa taxifolia*. Only a single tuft was met with growing in company with *Acrochætium seriatum* and other small epiphytes.

It forms a dense low tuft up to about 400 μ high.

The basal part consists of creeping filaments (Fig. 17 *d*) fusing more or less together but, it would seem, easily separable. The cells in these filaments are rather short, often nearly isodiametric but much irregular in shape. From nearly all of these cells with the exception of those near the margin erect filaments arise.

These (Fig. 17 *a*) are multilaterally ramified but not much so, and taper somewhat towards the upper end (Fig. 17 *c*). They consist of cylindric cells about 18—20 μ long; in the basal part these cells are about 5—6 μ broad while those at the summit are only 3—4 μ.

Fig. 18. *Acrochætium netrocarpum* nov. spec. Filament with sporangia. (About 800 : 1).

The shape of the chromatophore was not clearly visible, so far as I have been able to see it was parietal with a lateral pyrenoid; the last mentioned was more visible in the sporangia (Fig. 18).

The latter have a very characteristic shape (Figs. 17 *b*, 18); they are fusiform with a truncate summit, about 4—5 μ broad and 10—11 μ long. They are mostly sessile but often also pedicellate. They occur more or less in a series or may be more scattered.

This species has only been found once namely at Christianssted, St. Croix.

5. Acrochætium gracile nov. spec.

Thallus cæspitosus usque ad 1 mm. altus et ultra.

Pars basalis e filis repentibus, epiphyticis, plus minus lateraliter confluentibus composita. Fila erecta, simplicia aut paucis ramulis

Fig. 19. *Acrochætium gracile* nov. spec.
a and *b*, erect filaments with sporangia. *c*, base of a plant.
(*a* and *b*, about 150 : 1; *c*, 250 : 1).

in superiori parte instructa, ramulos sporangiferos, 1—2 raro plures cellulas continentes gerentia, ad apicem versus leniter attenuata ex cellulis cylindricis in inferiori parte filorum 5,5 μ

latis 10 μ longis, in superiori fere 2 μ latis et 20 μ et ultra longis composita. Chromatophorum parietale, pyrenoide laterali munitum.

Monosporangia aut sessilia aut pedicellata aut in ramulis posita oblonga, 14—16 μ longa, 6—8 μ lata.

The base of the plant (Fig. 19 *c*) consists of creeping epiphytic filaments which are mostly free or somewhat fused together. The cells in the basal part are about as long as broad or a little longer. They are 5,5 μ broad.

From the cells in this disc erect filaments arise. At the base these filaments (Fig. 19 *a*, *b*) are about 5,5 μ thick; they taper slowly towards the summits and often end with long hair-like prolongations in which the cells are only about 2 μ wide. In the lowest part of the filaments the cells are about 10 μ long, in the upper end on the other hand they often reach a length of about 20 μ and more.

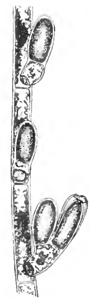

Fig. 20. *Acrochætium gracile* nov. spec. Part of a filament with sporangia. (About 800 : 1).

The chromatophore (Fig. 20) is parietal with irregular prolongations and contains a large pyrenoid lying near the wall of the cell and protruding deeply into the interior of the cell.

The filaments are not much branched, often not at all in the lowest part and bearing here for the most part only short branches with sporangia. In the upper part the filaments give off multilaterally situated branches, mostly only a few and these branches are as mentioned above often terminated by thin hair-like prolongations.

The branchlets bearing the sporangia are mostly multilaterally placed upon the lower part of the principal branches. But uniseriated branches also occur especially higher up in the filaments.

Most of the branchlets are unicellular, bearing a single or sometimes two sporangia, but two-celled branchlets are also common while others with several cells are found more rarely.

Sessile Sporangia are scarce but they occur now and then, especially in the upper end of the filaments.

The sporangia (Figs. 19 *a*, *b*, Fig. 20) are linear oblong, about 14—16 μ long, 6—8 μ broad.

This species was found upon old leaves of *Sargassum vulgare* growing here together with several other species.

Only found once in the Harbour of St. Thomas.

6. Acrochætium globosum nov. spec.

Thallus cæspitosus, globosus, ad 600μ altus; in *Chætomorpha antennina* epiphyticus.

Fig. 21. *Acrochætium globosum* nov. spec.
Part of a plant showing the basal creeping filaments from which arise erect filaments with opposite sporangiferous branchlets. (About 100:1).

Discus basalis bene evolutus, unistratosus, e filis repentibus ramosis, cellulis fere isodiametricis, compositus. Fila erecta numerosa, parce ramosa, ad apicem versus attenuata et in pseudopila producta; in basi et media parte 5—6 μ, in superiori parte 2—3 μ crassa, cellulis inferioribus c. 14 μ, mediis c. 30 μ, superioribus 70 μ vel plus longis. Chromatophorum parietale, pyrenoide laterali instructum.

Ramuli sporangiferi numerosi, sparsi aut sæpe oppositi, 1—3, rarius plures, cellulas continentes. Sporangia ovata, 7—8 μ lata et 8—10 μ longa.

This species was found upon *Chætomorpha antennina* upon which it forms small dense nearly globular or semiglobular tufts.

The basal part (Fig. 21) of the plant consists of creeping ramified filaments, more or less fusing together and forming in this way a large disc. The cells in the disc are rather irregularly shaped, about as long as broad or a little longer i. e. from 5 to 11 μ broad.

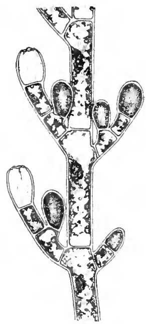

Fig. 22. *Acrochætium globosum* nov. spec. Part of a filament with branchlets bearing sporangia (some ones emptied). (about 600 : 1).

From this basal part numerous erect filaments grow up; those in the middle are nearly straight, those in the periphery are bent outwards in view of space and light. At the base the erect filaments are about 5—6 μ broad and the length of the cells about 14 μ. Upwards the length of the cells increases gradually reaching in the middle of the filaments about 30 μ. From here the cells not only grow longer but the filaments also taper towards their summits in such a way that the uppermost cells only reach a breadth of 2—3 μ while the length of the cells on the other hand is often more than 70 μ (Fig. 21). These thin unbranched prolongations of the filaments are nearly or quite colourless and hairlike. While the lowermost cells in the filaments taper a little at both ends those higher up in the filaments are cylindrical. The cells contain a slightly developed parietal chromatophore lying near the upper end of the cell and a lateral pyrenoid (Fig. 22).

The erect filaments are multilaterally ramified but not much. These branches contrast distinctly with the numerous short sporangiferous branchlets. Along the whole length of the filaments from their base and up to the beginning of the hair-like prolongations nearly all the cells bear either a single or more

often two opposite branchlets (Fig. 21). In the lowest part of the plant these branchlets consist of 2—3, rarely more cells, higher up of two, then of a single one only; at the top some few sessile sporangia may occur. The cells in the branchlets are about 3 μ broad and 8 μ long.

The sporangia are ovate about 7—8 μ broad and 8—10 μ long.

This species has been found at the very exposed coast at Northside, St. Croix.

7. **Acrochætium Sancti Thomæ** nov. spec.

Thallus sine pilis usque ad 200—300 μ altus. Discus basalis unistratus, e filis repentibus plus minus lateraliter confluentibus, compositus.

Fila erecta simplicia aut parce ramosa, e cellulis 8—9 μ latis et 16—18 μ longis composita.

Chromatophorum parietale, pyrenoide, ut videtur, centrali instructum.

Pili longi hyalini, initio terminales, postea pseudolaterales, adsunt.

Monosporangia plerumque sessilia et uniseriata, interdum pedicellata et opposita, solitaria vel bina in uno articulo, obovata, 7 μ lata et 10 μ longa.

This plant was found together with several other species upon old leaves of *Sargassum* vulgare forming small tufts.

Fig. 23. *Acrochætium Sancti Thomæ* nov. spec. *a*, *b*, *c*, three parts of different tufts showing sporangia-bearing filaments. *d*, *e*, bases of plants. *f*, basal filaments seen from above. (*a*, about 250:1, *b*, *c*, *e*, 130:1, *f*, 250:1, *d*, 500:1).

The base (Fig. 23 *d*, *e*, *f*) consists of creeping filaments irregularly ramified and more or less fusing together into a pseudoparenchymatous disc.

From most of the cells in the creeping filaments erect ones are given off. These filaments are composed of cells nearly twice as long as broad, 8—9 μ thick and 16—18 μ long; the lowest are nearly cylindrical, higher up in the filaments the cells are more barrelshaped being somewhat swollen in the middle (Figs. 23 *a*, 24).

The cells contain a large parietal chromatophore with long lobes along the walls of the cells (Fig. 24) and with a pyrenoid lying near the middle of the cell. The shape of the chromatophore seems to come near to that ROSENVINGE found in *A. (C.) leptonema*. The cells are mostly very rich in starch filling up the greater part of the lumen making it difficult to see the shape of the chromatophore.

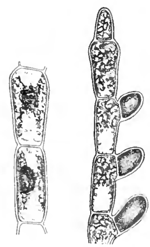

Fig. 24. *Acrochætium Sancti Thomæ* nov. spec. *a*, summit of a filament with sporangia. *b*, cells from lower down in a filament with chromatophores and nuclei. (About 500 : 1).

The filaments are mostly slightly ramified, often not at all. However, the more vigorously developed filaments sometimes give off branches like themselves. Short branchlets on the other hand are often present (Fig. 23 *a*).

The cells bear often long, hyaline, unicellular hairs (Fig. 23 *b*, *c*). These are at first terminal on the end of the filaments but later on they are pushed to the side by the next new cell in the way described for several species by KYLIN and ROSENVINGE, and the sympodial nature of the filaments was clearly visible in this species.

The hairs are thickest near the base, here about 4 μ broad, tapering towards the summit where their diameter is only about 2 μ long; they reach a length of about 200—300 μ. The hairs are quite hyaline with the exception of the uppermost end which is richly provided with contents. They seem to be rather early shed.

The monosporangia are mostly sessile, arranged in series upon the upper end of each cell in the filaments, some are pedicellate, placed upon the short branchlets mentioned above (Fig. 23 *a*). The sporangia are oval-obovate in shape (Fig. 24 *a*), about 7 μ broad and 10 μ long.

This species is certainly nearly related to *Acrochætium leptonema*

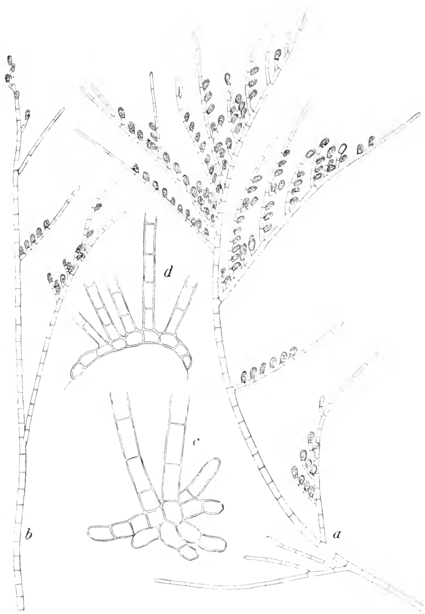

Fig. 25. *Acrochætium seriatum* nov. spec. *a*, *b*, erect filaments with monosporangia. *c*, base of a small plant seen from above. *d*, transverse section of the base; the lines at both end are the surface of the host plant. (*a*, *b*, about 130 : 1; *c*, 400 : 1; *d*, 275 : 1).

Rosenv.; but to judge from the figures of Rosenvinge the habit of his plant is very different from the mine. Further the filaments in his plant are only half as broad as those in my plant and the sporangia also are somewhat smaller.

Only found once: St. Thomas, The Harbour.

8. Acrochætium seriatum nov. spec.

Thallus cæspitosus usque ad 1 mm altus e disco basali in filamentis hospitis epiphytico et filis erectis ramosis constructus.

Discus basalis unistratosus, e filis repentibus confluentibus, cellulis brevibus fere isodiametricis irregulariter formatis compositus. Fila erecta a basi quoquoversum ramosa in superiori parte secundatim ramosa, ramis principalibus vix, minoribus plus minus ad apicem versus attenuatis.

Cellulæ in parte basali ca. 22 μ longæ, diametro ca. 8—10 μ lato, in superiori parte diametro ca. 6—7 μ, interdum 4 μ lato, et ad 30 μ longæ, chromatophorum parietale lobatum, pyrenoide laterali instructum continentes.

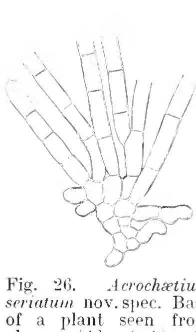

Fig. 26. *Acrochætium seriatum* nov. spec. Base of a plant seen from above. (About 400 : 1).

Sporangia ovalia, 9—10—13 μ longa et 6—9 μ lata, sessilia aut interdum pedicellata, in latere superiori ramorum plerum-

que secundatim ordinata, rarius plus minus sparsa.

This species is an epiphyte especially upon *Centroceras* but it is also found upon other algæ e. g. *Gracilaria*, *Chætomorpha*, *Caulerpa taxifolia* etc. It forms small more or less dense tufts from 500 μ up to double this height.

The basal part (Fig. 25 *c*, Fig. 26) consists of short irregularly bent creeping filaments, fusing together in the middle into a small disc; it is composed of short rather thickwalled cells.

From the cells in the middle of this disc several erect filaments gradually arise. The filaments consist in their lower parts of cells about twice as long as broad, namely 8—10 μ broad and 16—22 μ long. Upwards the filaments taper gradually, reaching near the summit about 6—7 μ, while the length of the cells is mostly about the same throughout the whole filament, but thinner branches occur in which the cells are only about 4 μ broad while on the other hand the length may reach up to 30 μ.

The erect filaments are branched often from quite near the base, in the lower part from all sides, higher up often quite unilaterally with the branches lying in the same plane; the branches are again ramified in the same way (Fig. 25 *a*); from this the plant often gets an elegant pectinate appearance.

The cells contain a parietal chromatophore often with long prolongations along the wall of the cells and with a large lateral pyrenoid much protruding into the interior of the cell (Fig. 28); in some specimens the chromatophore is large covering nearly the whole wall with the exception of a small part near the ends of the cells;

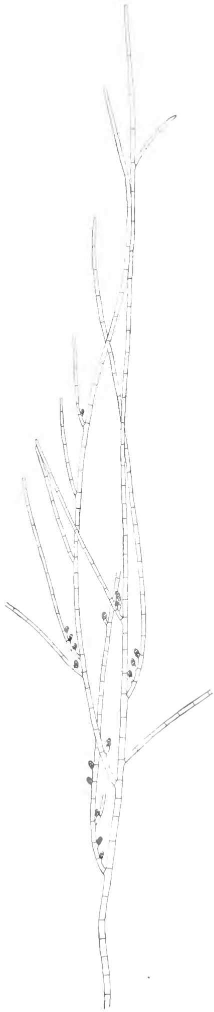

Fig. 27. *Acrochætium seriatum* nov. spec. Habit of an erect ramified filament with sporangia. (About 135 : 1).

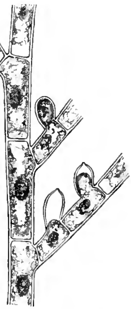

Fig. 28. *Acrochætium seriatum* nov. spec. Part of filaments with sporangia. (About 450 : 1).

in others it is reduced to an often narrow belt lying a little above the middle of the cell.

The sporangia are monosporous, oblong-ovate, 9—11—13 μ long, 6—9, mostly 7—8 μ broad. They are as a rule sessile and usually secundly seriated in long rows placed on the inner (upper) side of the branches from the base upwards (Fig. 25 *a*); but more scattered sporangia also occur (Fig. 27) just as pedicellate sporangia are by no means rare.

The present plant has a great likeness to *Chantransia Hypneæ* but this differs in having endophytic basal filaments. Further it is also related to *Acrochætium flexuosum* Vickers. But in this plant the monospores are secund upon short ramuli, while in the present the ramuli are wanting, the monospores being placed in long series upon the branches.

This species has been found mostly in more sheltered localities. It seems to be common.

St. Croix: Coakley Bay, Christiansted, Lt. Princess, Sandy Point; St. Thomas: The Harbour.

9. Acrochætium flexuosum Vickers.

Vickers, A., Liste des Algues de la Barbade. (Ann. sciences nat. IX Sér., Bot. 1905, vol 1, p. 60).

A quite certain determination derived from the somewhat imperfect diagnosis of M^{lle} Vickers seems impossible, and had the plant I now suppose to be this species not grown upon *Chætomorpha antennina* it had perhaps not occurred to me to refer it to this species.

The plant found forms dense tufts about 700 μ high; it has a large base composed of creeping filaments more or less fusing together in the inner part.

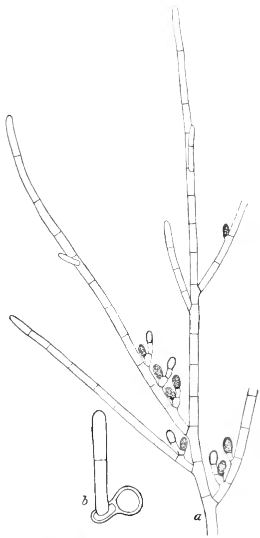

Fig. 29. *Acrochætium flexuosum* Vickers. *a*, part of a filament showing branchlets with sporangia. *b*, a young plant. (*a*, about 125:1. *b*, about 160:1).

Fig. 29 *b* shows a supposed young plant. The germinating spore has given off a single cell, the earliest beginning of the creeping basal filaments, and from this cell an erect filament arises.

In the full grown plant a great number of erect filaments grow up from the inner part of the basal part; those in the middle are straight, those in the periphery are bent outwards. In the lower part the filaments are about 9—10 μ broad tapering somewhat towards the summit where the diameter of the cells is only about 6—7 μ. The cells are about 2—3 times as long as broad in the basal part, reaching a length of about 18—35 μ; in the upper part the length is about 30—35 μ.

The cells contain a parietal chromatophore (Fig. 30) with longer or shorter prolongations along the wall of the cell and a large lateral pyrenoid protruding greatly into the interior of the cell.

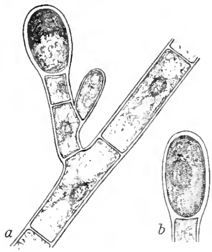

Fig. 30. *Acrochætium flexuosum* Vickers. *a*, part of a filament with sporangia - bearing branchlet. *b*, a sporangium more developed. (About 700 : 1).

The sporangia are situated upon small secund mostly two-celled branchlets (Fig. 29 *a*); they are placed on the upper, inner side of the branches upwards from the axils. They are ovate-oblong (Fig. 30); 14—16 μ long and 9—10 μ broad.

This species is evidently nearly related to *Acrochætium Sagræanum* Bornet[1]). I have compared my specimens with the large plant distributed in Phycotheca Bor.-Am. Nr. 39 under the name of *Chantransia virgatula* and upon which Bornet has partly based his description of this species. But the present species is much smaller and differs among other things by having proportionally shorter cells.

This species seems to be common upon *Chætomorpha antennina* of which the ends of the filaments often are red coloured by the epiphyte.

St. Croix: Northside.
Geogr. Distrib.: Barbados.

10. **Acrochætium unipes** nov. spec.

Thallus usque ad 2 mm altus, a basi ad apicem versus attenuatus. Spora germinans, deorsum prolongationem subsphæricam endo-

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[1]) Bornet, E., Deux *Chantransia corymbifera* Thuret. *Acrochætium* et *Chantransia* (Bull. Soc. Bot. Fr., t. 51, 1904, p. XXI).

phyticam in cellulas hospitis, sursum filum erectum sporangiferum emittens.

Filum erectum a basi nudum in superiore parte ramosum ramis sparsis plus minus ramosis. Cellulæ cylindricæ in inferiori

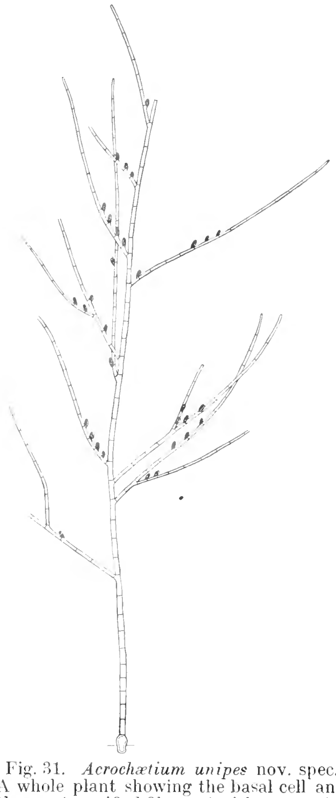


Fig. 31. *Acrochætium unipes* nov. spec. A whole plant showing the basal cell and the erect ramified filament with sporangia-bearing branches. (About 70 : 1).

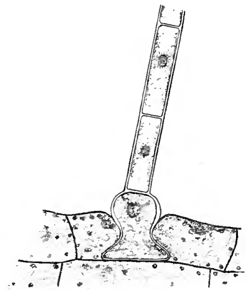


Fig. 32. *Acrochætium unipes* nov. spec. Base of a plant. (About 450 : 1).

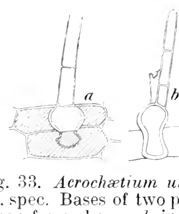


Fig. 33. *Acrochætium unipes* nov. spec. Bases of two plants; *a*, seen from above. *b*, in vertical section. (About 200 : 1).

parte ca. 11—12 μ latæ, 50 μ longæ, in superiori fere 5 μ latæ, 50—60 μ longæ, chromatophorum parietale, pyrenoide laterali instructum continentes.

Sporangia in filis lateralia, uniseriata, sessilia, oblonga, 9—11 μ lata et 20—22 μ longa.

This species was found in a depth of about 10 meters[1]) growing upon *Dictyota linearis*.

The largest specimen found had a length of up to 2 mm.

The base of the plant consists of the original spore which during germination penetrates into the epidermal cells of the host forming a process (Figs. 32, 33); this is thinnest in its upper end where it passes through the wall of the host broadening more out downwards getting a somewhat obovate-clavate shape, by means of which the plant becomes more strongly fixed to the substratum. The process reaches in all a length of about 35 μ and reaches often the lower wall in the cell of the host plant.

The spore itself lies freely above the wall of the host plant; it is nearly spherical with proportionally thick wall; its diameter reaches a length of about 20—22 μ.

From this basal body a single erect filament grows upwards; once only did I find two filaments arising from it (Fig. 33 *b*); but in this plant the primary filament had been destroyed and then another one was given off at the side of the first one.

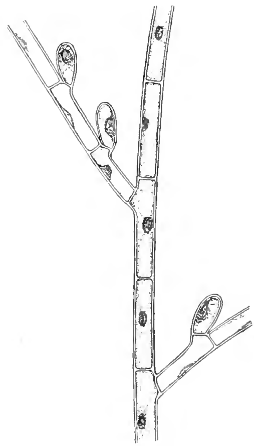


Fig. 34. *Acrochætium unipes* nov. spec. Part of the thallus with sporangia. (About 425:1).

The erect filament is straight and at first not branched, higher up branches are given off to all sides (Fig. 31); these are also very straight and issued from the principal filament in an acute angle and most often branched in a similar way. Against their summit all the filaments taper somewhat.

The cells in the principal filament and the lowermost cells in the branches are cylindric, somewhat thick-walled, their diameter reaching a length of about 9—11 μ and their length up to 50 μ. In the summit on the other hand the cells are only about 5 μ thick while their length is about 50—60 μ.

The cells contain a parietal chromatophore with a pyrenoid lying at the wall (Fig. 34).

The monosporangia (Figs. 31 and 34) occur upon the inner

[1]) By a misprint is the depth in vol. I, p. 210 said to be 40 meters.

side of the lowermost part of the branches; they are in the specimens found always uniseriated and sessile.

The sporangia are oblong clavate reaching a length of about 20—22 μ and a breadth of 9—11 μ. The sporangia found were apparently not quite ripe.

To judge from the description of *Acrochætium Hoytii* Collins[1]) this plant seemingly comes near to my plant. *Acrochætium Hoytii* seems to have a very similar base, but it has 1—3 erect filaments which only reach a diameter of about 6 μ; further it appears to be more branched and the sporangia are pedicellate and much smaller than those in my species. I wished very much to compare my plant with that distributed in Phycotheca Bor.-Am., No. 1540 and have also examined the material distributed but did not succeed in finding the plant in the material to which I had success.

Acrochætium unipes has only been found once in a depth of about 6 fathoms.

St. Croix: Frederiksted.

11. **Acrochætium opetigenum** nov. spec.

Thallus 1—2 mm altus. Spora germinans globosa, processum decumbentem cuneiformem in cortice hospitis (*Dasyæ elegantis*) endophyticum et filum erectum sporangiferum procreat.

Fila erecta, a basi ramosa, cellulis cylindricis ad 80 μ longis, ad basin ca. 8—11 μ latis, in media parte 13—14 μ latis ad apicem versus paulo attenuatis ca. 6—7 μ latis. Chromatophorum parietale pyrenoide laterali instructum.

Ramificatio uberrima, rami sparsi. Monosporangia sessilia aut pedicellata ad basin ramorum 2—3 præsentia, oblonga vel subcylindrica, c. 11 μ lata c. 27 μ longa.

This species is the largest *Acrochætium* found on the shores of the islands; well grown specimens reach a height of up to 1—2 mm or more and form a dense much branched tuft.

The base (Fig. 36) consists of the original spore from which an elongated cuneate prolongation grows downwards and penetrates into the tissue of the host plant (*Dasya elegans*). This endophytic part reaches a length of about 20 μ.

In some plants, especially the older and more vigorous (Fig. 36 *b*) is furthermore developed one or a few short horizontal

[1]) Collins, F. S., Two new species of Acrochætium (Rhodora, vol. 10, 1908, p. 134).

filaments from the lowermost part of the spore. These filaments consist of a few cells only and lie along the surface of the host in which they are not imbedded, or at the most only a little on their lower side. From the cells in these creeping filaments erect ones were found growing up in a few vigorous specimens (Fig. 36 *b*). The spore itself is quite globular, about 17 μ in diameter; it lies upon the surface of the host plant. The plants are mostly fixed at the base of the pinnules of the host and many plants are often found surrounding each pinnule (Fig. 36 *a*). Most probably the germinating spore finds more shelter here. But plants occur also on other parts of the host and even upon the pinnules themselves. From each spore a single (or in more vigorous plants two or more) erect filaments grow up. They consist of cylindric cells; in the basal part their diameter is about 8—9—11 μ, higher up the diameter increases and in vigorous plants it reaches a length of 13—14 μ. The length of the cells is often 80 μ and more. Towards the summit the filaments again taper, their diameter reaching only 6—7 μ, but the ends are not hairlike and the cells contain both chromatophore and pyrenoid (Fig. 35).

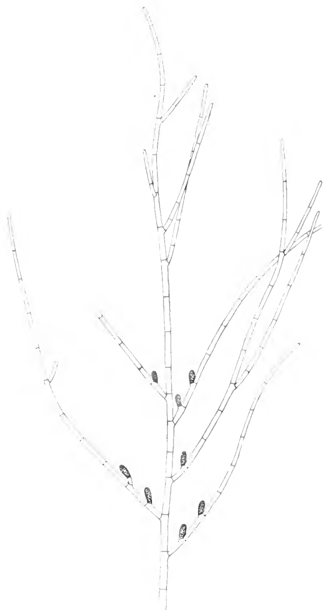


Fig. 35. *Acrochætium opetigenum* nov. spec. Small part of an erect ramified filament. (About 90 : 1).

The chromatophore (Fig. 37) is parietal, often with long prolongations along the wall of the cell and it contains a large lateral pyrenoid protruding markedly into the interior of the cell.

The ramification begins from near the base but is further developed higher up. It is multilateral and the branches ramify copiously in the same manner.

The sporangia (Fig. 35, 37) are oblong-oval or more elongated, subcylindric or subclavate. They are mostly sessile but

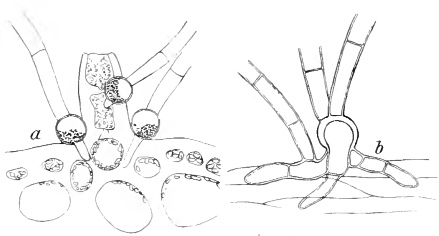


Fig. 36. *Acrochætium opetigenum* nov. spec. *a*, Transverse section of *Dasya elegans* with basal parts of three plants two of which fixed to the base of a pinnule and showing the cuneate endophytic process penetrating into the tissue of the host and one fixed to the pinnule itself. *b*, basal part of an older vigorous plant showing the endophytic cuneate process and further two short epiphytic branchlets; from that to the left an erect filament is issued. (About 200 : 1).

pedicellate examples also occur. The sporangia are placed upon the lowermost cells of the branches mostly only two or three upon each filament ; but they also occur upon the main filaments.

Collins has described an *Acrochætium* (*A. Dasyæ*) also found upon *Dasya elegans* which seems closely related to the present species. It has for instance the same globular persistent basal spore but this emits, as described by Collins, "a short, descending process, sometimes branched, of a few small rounded cells, attached to the host". I have examined the specimens, distributed in Phycotheca Bor.-Am., No. 1342 and have seen these short, 2—3 celled branches. As far as I can observe these branches are not endophytic and they are upon the whole quite different to the descending process found in my plant. Besides this difference my species has a very different appearance, is much larger in all parts of the thallus, much more branched and the ramification is not secund.

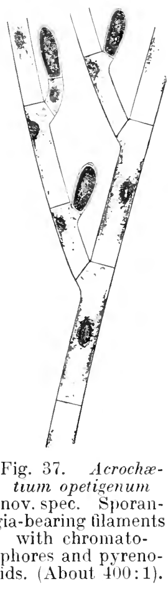


Fig. 37. *Acrochætium opetigenum* nov. spec. Sporangia-bearing filaments with chromatophores and pyrenoids. (About 400 : 1).

Found upon *Dasya elegans* in a depth of about 20 meters.

St. Jan: Off Cruz Bay.

12. Acrochætium robustum nov. spec.

Thallus cæspitosus, usque ad 1 mm longus, e filis erectis et filis horizontalibus epiphyticis compositus.

Spora germinans in texturam hospitis paulum penetrans; a superiori parte, non immersa, fila brevia repentia, plus minus lateraliter con-

fluentia, egrediuntur, et sic discum basalem formant, ex cellulis brevibus, diametro fere æquilongis, pariete crasso compositum. Fila erecta a basi ramosa, apicem versus sensim paulum attenuata, in parte basali 9—10 μ lata, superne ca. 5 μ. Cellulæ cylindricæ 9—10 μ latæ, inferiores 15—20 μ longæ, superiores ca. 40 μ longæ, chromatophorum parietale, pyrenoide laterali instructum continentes.

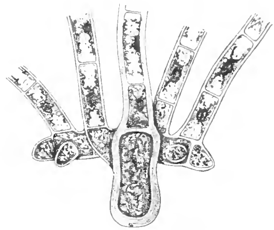


Fig. 38. *Acrochætium robustum* nov. spec. Base of a plant. (About 450 : 1).

Rami sparsi, nonnunquam secundati, ramulis sparsis, uni-, bi- aut tricellularibus, monosporangia gerentibus instructi.

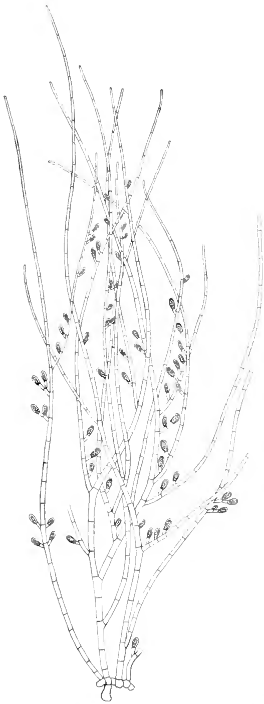


Fig. 39. *Acrochætium robustum* nov. spec. Habit of a plant. (About 140 : 1).

Sporangia ovata, ca. 11 μ lata et 12—14 μ longa.

This species was found together with several other species upon old leaves of *Sargassum vulgare*. The base (Fig. 38) of the plant consists of a pluricellular disc composed of thickwalled cells. From this an unicellular, thickwalled process grows downwards fixing the plant strongly to the host plant; how far these processes also should serve as haustoria like those described by ROSENVINGE for *Chantransia cytophaga*, I have not been able to decide. The processes reach a length of about 20 μ; the basal disc is about 8—10 μ thick.

Not having succeeded in finding quite young plants I have not been able to follow the development of the basal disc, but most seemingly the germinating spore produces the process during germination (compare Fig. 38) and this grows downwards in the tissue of the host plant; afterwards from its upper end

short horizontal filaments grow out which fuse together forming the disc.

From the cells in the disc gradually several erect ramified filaments grow upwards forming a dense tuft (Fig. 39).

The principal filaments consist in their lower part of short cells about $1^1/_2$—2 times as long as broad, their diameter reaching a length of about 9—10 μ; upwards the filaments become gradually thinner and the cells at the same time longer. Near the summit they are only about 5 μ thick and often upto 40 μ long or more. Sometimes the cells in the lower part of the principal filaments are a little broader in the middle tapering towards both ends.

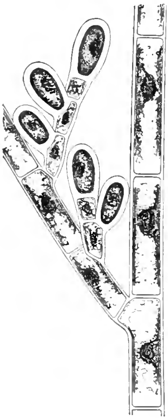


Fig. 40. *Acrochætium robustum* nov. spec. Part of a filament with sporangia-bearing branchlets. (About 700:1).

The chromatophore (Fig. 40) is parietal often with some longer prolongations along the wall of the cell and contains a large pyrenoid projecting somewhat into the interior of the cell.

The ramification of the filaments begins near their base, but on the whole the filaments are not much branched. Branches are given off to all sides but often with long interwalls. Two kind of branches are present, long filaments like the principal ones and short branchlets upon which the sporangia are borne.

The branchlets are as a rule one- or two-celled; in the first case it bears a single terminal sporangium, in the latter the lower cell also bears a mostly pedicellate, more rarely sessile, sporangium. The last mentioned branchlets occur mostly in the lower part of the tufts, while the first mentioned as a rule are only present in the upper part. Only rarely are the sporangia seated directly upon the main filaments. Branchlets with more than two cells are rare.

The sporangia (Fig. 40) are monosporous, oval-ovate, about 11 μ broad and about 14—16 μ long; they are provided with a very thick wall, often up to 2 μ thick.

This species seems at first sight to come near to *Acrochætium Hypneæ*; but it differs in a different arrangement of the spores, these being sessile and seriated in *Acr. Hypneæ*; further *Acr. Hypneæ* has endophytic filaments which I have not found in

the present species, and the sporangia are rounder and have not the thick wall of *Acr. robustum*.

Found upon *Sargassum vulgare* in sheltered place.

St. Thomas: The Harbour.

13. Acrochætium bisporum Borgs.

Chantransia bispora Borgs., Some new or little known West Indian Florideæ, II ("Botanisk Tidsskrift", vol. 30, 1910, p. 178).

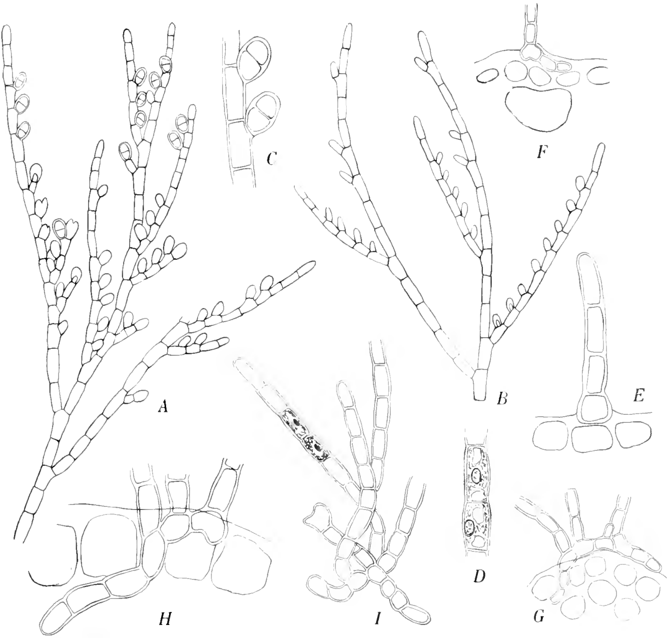


Fig. 41. *Acrochætium bisporum* Børgs. *A*, part of a plant with sporangia with two spores. *B*, part of a plant with monosporangia. *C*, sporangia with two spores. *D*, cells with chromatophore and pyrenoid. *E*, a young plant. *F*, *G*, *H*, *I*, basal parts of plants. (*A*, *B*, about 120 : 1, *F*, *G*, *I*, about 250 : 1, *C*, *D*, *E*, *H*, about 350 : 1).

In the former description of this plant, I have pointed out that it is perhaps nothing more than a variety of *Acrochætium Hypneæ*. I had hoped when looking through my collections to refind it again and by a renewed examination be able to settle this question.

But unfortunately I have not been successful and therefore I am forced to adhere to my former position. As there mentioned this species was found upon *Acanthophora spicifera* (Vahl) Børgs. From the basal cell which to begin with is roundish and thickwalled (Fig. 41 *E*) short creeping filaments grow out; some of these are epiphytic creeping upon the surface of the *Acanthophora*, others penetrate into the tissue of the host-plant (Figs. 41 *F*, *G*, *H*, *I*) but it sometimes happens that young plants occur which are not at all parasitic. From the basal layer several erect filaments gradually arise. The cells are usually a little constricted at the cross-walls; they contain a well-developed parietal chromatophore with a large lateral pyrenoid. The cells are about 8 μ broad and about 20 μ long and mostly $2\frac{1}{2}$ times as long as broad with some variations. The filaments are usually only slightly branched in the lower part, more so higher up; the side-branches grow out at an acute angle from the mother-branch and in well-developed plants the branches are again multilaterally ramified.

Most of the specimens had monosporangia; these are ovate-oblong, 6 μ broad and 10 μ long, as a rule sessile, more rarely pedicellate, serially arranged upon the upper side of the branches. Sporangia divided into two spores were only found in few plants; these are larger than the monosporangia, oval, about 9 μ broad and 14 μ long; they are mostly sessile, sometimes pedicellate or placed upon short branchlets. In my former description I remarked that a single sporangium was found in which the upper half was again divided by a vertical wall. How far this suggests that the plant in reality has tetraspores, the specimens found representing only a young state of development, can only be settled by means of more material.

Acrochætium bisporum has been found only once, in the Harbour of St. Thomas.

Geogr. Distrib., Danish West Indies.

14. **Acrochætium occidentale** nov. spec.

Thallus usque ad 1—2 mm altus, e filis erectis ramosis sporangiferis et filis endophyticis constructus.

Spora in filamentis assimilatoricis hospitis germinans, magna, ovata—globularia, e parte basali fila circum filamenta hospitis repentia, e parte superiori filum erectum singulum gignit.

Filum erectum inferne nudum media parte ramosum, ramis sparsis ad apicem versus attenuatis instructum.

Cellulæ cylindricæ in inferiori parte filorum ca. 11 μ latæ 40 μ longæ, in superiori 7—8 μ latæ 40 μ longæ, chromatophorum parietale, pyrenoide laterali, instructum continentes.

Sporangia sessilia, raro pedicellata in parte basali ramorum uniseriata, monospora aut raro bispora, ovalia, ca. 18—20 μ longa et 9—12 μ lata.

The basal part of this species is immersed in the mucilage and chalk incrustation of the host plant (*Liagora elongata*).

On germination the spore does not divide and remains throughout undivided; its diameter is about 16 μ. After the germination it produces endophytic filaments from its lower side; these creep downwards fixing themselves to the assimilating filaments of the host plant (Fig. 42 *c*).

From the upper end an erect filament (or sometimes two) is given off (Fig. 42 *a*); this is at first undivided but after having grown so that it is quite free of the *Liagora* tissue it becomes branched. The ramification is somewhat slight. The branches are given off at an acute angle and the branches themselves are ramified in the same way giving the plant a cluster-like appearance.

Towards the summit the branches taper into hair-like filaments the cells of which are long and nearly colourless and soon die away at the end (Fig. 42 *a*).

The cells in the filaments are about 10—11 μ thick and about 27—40 μ long; near the base the filaments are a little thinner, about 8 μ; in the hairlike ends the cells taper to about 7—8 μ.

The chromatophore (Fig. 43) is parietal, often with elongations towards the wall of the cell and it encloses a lateral pyrenoid.

The sporangia (Figs. 42 *a*, *b*, Fig. 43) are sessile, oval-ovate. They are about 9—12 μ broad and 18—20 μ long. Monosporangia mostly occur, but in a few specimens some were divided by a transverse wall into two spores (Fig. 43).

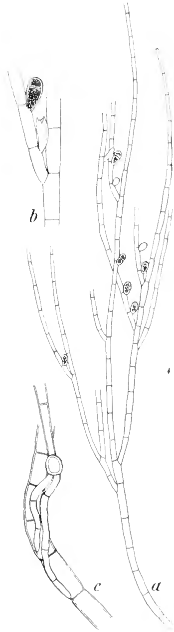


Fig. 42. *Acrochætium occidentale* nov. spec. *a*, erect filament with sporangia. *b*, part of a filament with sporangia, the uppermost divided into two spores, the lowermost emptied. *c*, base of a plant fixed to the assimilating filaments of *Liagora*. (*a*, about 125 : 1; *b*, 250 : 1; *c*, 200 : 1).

It is perhaps not impossible that *Acrochætium Barbadense*

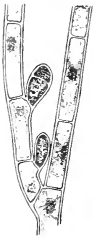


Fig. 43. *Acrochætium occidentale* nov. spec. Branch with sporangia, the uppermost divided into two spores. (About 400 : 1).

(Vickers) is the same as this species. But the description of M[lle] VICKERS is so defective that any identification by help of it is impossible and as: "Les échantillons, mal conservés, ne se prètent pas bien à l'étude", any help from the original material seems also excluded.

The bases of the two plants in question are apparently alike and they are both living upon *Liagora*. BORNET and M[lle] VICKERS refer the plant to *Chantransia* which suggests that the plant from Barbados had sexual organs; these I have never found in my plant. As to the arrangement of the monospores of *Acr. Barbadense*, their form and size nothing is said just as no description is given of the sexual organs.

St. Croix: Long Point.

15. Acrochætium comptum nov. spec.

Thallus usque ad 1 mm altus et ultra, e filis erectis ramosis sporangiferis et filis endophyticis compositus.

Spora in filamentis assimilatoriciis hospitis germinans, magna, oblonga, in cellulas duas divisa est; e cellula inferiori fila decumbentia circa filamenta hospitis repentia, e cellula superiori filum singulum erectum gignitur.

Filum erectum inferne nudum, superne ramosum ramis vicissim plus minus ramosis ramos seriatos gerentibus instructum.

Cellulæ cylindricæ 8—11 μ latæ, ca. 35 μ longæ, chromatophoro parietale pyrenoide laterali instructæ.

Sporangia monospora, plerumque sessilia, nonnumquam in ramulis unicellularibus posita, singula vel bina, in parte basali ramorum uniseriata, ovata, 11—14 μ lata et 18 μ longa.

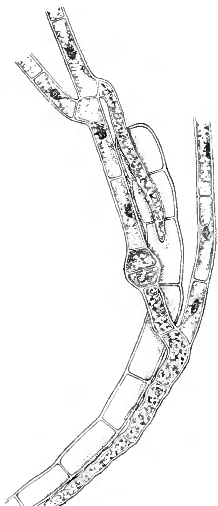


Fig. 44. *Acrochætium comptum* nov. spec. Basal part of a plant showing the original spore divided into two cells. (About 350 : 1).

This species is characterized by the fact that the germinating spore is divided by a transverse wall into two cells from the upper of which an erect filament

grows upwards, while from the lower endophytic filaments growing downwards are produced (Figs. 44, 45 *c* and *d*). The last mentioned filaments grow downwards round the assimilating filaments of the *Liagora* upon which the spore has germinated. They do not penetrate into the cells of the host plant but only into the mucilage and chalk incrustation found between the filaments.

The main filament arising from the germinating spore remains in most of the specimens undivided in the basal part (Fig. 45 *a*), but specimens were found in which a single or few branches were given off from near the base. In some of the more adult specimens erect filaments were found growing up from cells in the descending filaments (Fig. 44). On one occasion a descending filament was found growing out from a cell near the base of the erect filament (Fig. 44). The cells in these are about 8—11 μ broad and their length about 35 μ.

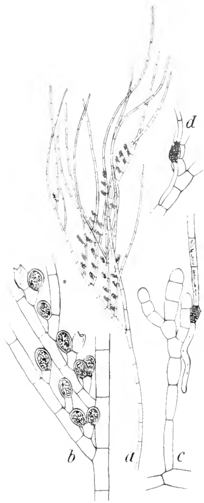


Fig. 45. *Acrochætium comptum* nov. spec. *a*, habit of erect, ramified filament with sporangia. *b*, part of plant with sporangia. *c* and *d*, bases of plants. (*a*, about 50 : 1; *b*, 250 : 1; *c* and *d*, 150 : 1).

When the erect filaments have grown long enough to become free of the *Liagora* they begin to branch more freely.

The branches issue from the upper end of each cell mostly in an uniseriate manner; these branches bear again branches arranged secundly. Towards their apex the branches are undivided tapering somewhat becoming about 8 μ thick, at the same time the chromatophores are not so well developed.

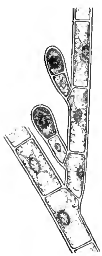


Fig. 46. *Acrochætium comptum* nov. spec. Part of a filament with sporangia. (About 400 : 1).

The chromatophore is parietal (Figs. 44, 46) with a large pyrenoid.

The sporangia are broad oval and mostly pedicellate (Figs. 45 *a*, *b*, Fig. 46), placed upon short secund branchlets being seriately arranged upon the upper, inner side of the branches. The branchlets are as a rule one-celled and bear mostly a single sometimes two sporangia. Sessile

sporangia also occur often rather numerous especially in the upper part of the plant. The diameter of the sporangia is about 11—14 μ, the length about 18 μ.

This species has been found upon *Liagora pinnata.*

St. Croix: White Bay.

16. Acrochætium Avrainvilleæ nov. spec.

Thallus cæspitosus usque ad 1 mm altus. Pars basalis ex interiori parte plectenchymatis hospitis emergens, ex filis brevibus in filis hospitis externe repentibus composita.

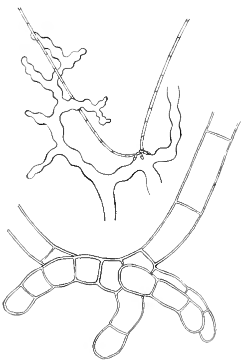


Fig. 47. *Acrochætium Avrainvilleæ* nov. spec. *a*, filaments of *Avrainvillea nigricans* with the basal part of the *Acrochætium*. *b*, base of the same plant more magnified. (*a*, about 40 : 1; *b*, 700 : 1).

Tota planta a basi ad apicem sensim attenuata.

Fila erecta, a basi simplicia, in superiori parte ramosa, ramis multilateralibus, rectis, plus minus ramosis instructa.

Cellulæ cylindricæ, in parte basali ca. 9 μ latæ 33 μ longæ, ad apicem versus ca. 4 μ latæ 50 μ longæ, chromatophorum parietale, pyrenoide laterali instructum continentes.

Sporangia sessilia aut interdum pedicellata, sparsa aut pauca seriata, oblonga, 11 μ lata, 22 μ longa.

This plant was found upon an old specimen of *Avrainvillea nigricans.* The basal part of it was fixed to a filament of the host plant lying rather deep in the cortical plectenchyma (Fig. 47 *a*); on account of its very loose texture the *Acrochætium* has no difficulty in growing out through it, and as I have only met with two specimens of it in all I dare not deny the possibility that the *Acrochætium* might be found quite epiphytic upon the external filaments of the host.

The basal part consists of short, creeping filaments attached to the surface of the filaments of the host plant; they consist of proportionally short and thick-walled cells.

From the cells in the middle of the basal filaments the erect ones are given off (one or more).

At their base the erect filaments are unbranched (Fig. 48);

higher up when they have become free of the host plant do they begin to branch. They are multilaterally ramified and the branches are straight and given off from the axis at an acute angle.

The principal filaments are thickest near their middle or a little above where the ramification begins; here the diameter of the cells reaches a length of about 9 μ. At their base the cells are only about 5,5 μ thick. Towards the summit the branches taper again, the cells here becoming thinner and at the same time longer and with less contents. The cells are cylindrical, not constricted at the transverse walls, in the basal part about 33 μ long, while near the summit on the other hand their length can reach 50 μ or more.

The chromatophore (Fig. 49) is parietal, often not much developed and contains a large lateral pyrenoid projecting greatly into the interior of the cell.

Fig. 48. *Acrochætium Avrainvilleæ* nov. spec. Habit of erect ramified filament with sporangia. (About 70 : 1).

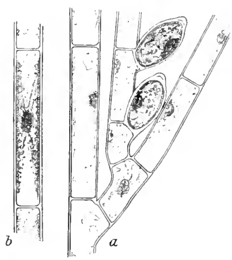


Fig. 49. *Acrochætium Avrainvilleæ* nov. spec. *a*, part of a filament with sporangia. *b*, cell with chromatophore and pyrenoid. (About 600 : 1).

The monosporangia (Figs. 48, 49) are sessile or more rarely pedicellate, usually occurring on the inner side of the branches near their base, seriate or a few together; but sometimes more irregularly.

The sporangia are oblong, about 22 μ long and 11 μ broad. Found once only in deep water (about 20 meters).
St. Jan: Off Cruz Bay.

17. Acrochætium hormorhizum nov. spec.

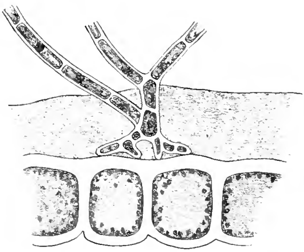


Fig. 50. *Acrochætium hormorhizum* nov. spec. Base of a plant. (About 250 : 1).

Thallus cæspitosus usque ad 1 mm altus et ultra, e filis endophyticis brevibus horizontalibus ramosis et filis erectis, a basi ramosis, sporangiferis constructus.

Fila endophytica in exteriorem partem membranæ cellularum hospitis (*Champiæ parvulæ*) penetrantia, ex cellulis brevibus pariete crassiori composita, discum basalem minorem supra cellulas maximas hospitis formantia.

E disco basali fila erecta creantur, ramis numerosis plus minus ramosis sparsis in superiori parte filorum uniseriatis.

Cellulæ in inferiori parte filorum diametro fere 4—5-plo longiores, 9—11 μ latæ, in superiori parte 8—9 μ latæ diametro fere 7-plo longiores.

Chromatophorum parietale, pyrenoide laterali munitum.

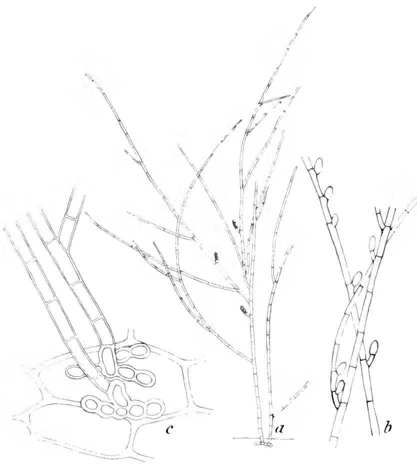


Fig. 51. *Acrochætium hormorhizum* nov. spec. *a*, habit of a plant. *b*, filaments with sporangia. *c*, base of a plant seen from above. (*a*, about 70 : 1; *b*, 150 : 1; *c*, 250 : 1).

Sporangia sessilia aut rarius pedicellata, sparsa aut pluria seriata, oblonga, fere 20—22 μ longa et 10—11 μ lata.

This species was found on *Champia parvula* upon which it forms small cushions about 1 mm high.

The germinating spore grows downwards through the thick peripheral wall of the host plant until it arrives at the more compact innerwall of the cells. Here it ramifies sending out some few short horizontal branches (Fig. 50). These consist of thick-walled cells nearly as long as broad or a little longer and much swollen in their middle part, the endophytic filaments thus assuming a moniliform appearance (Fig. 51 *c*). The length of the cells is about 12—14 μ and the breadth about 11 μ.

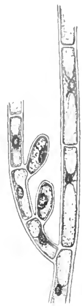


Fig. 52. *Acrochætium hormorhizum* nov. spec. Part of a filament with sporangia. (About 400:1).

From this endophytic basal part the erect free filaments arise (Figs. 50, 51 *a*, *c*). These are more or less ramified through their whole length, in the lowermost part on all sides, but higher up often uniserially; they taper only slightly towards their summits. The filaments consist of cylindrical cells which at the basal part are about 9—11 μ broad and about 30—50 μ long, in the upper end 8—9 μ broad and about 60 μ long. The branches ramify repeatedly. All the branches are mostly rather straight.

The cells contain a plate-shaped chromatophore (Fig. 52) with a well developed pyrenoid protruding somewhat into the interior of the cell.

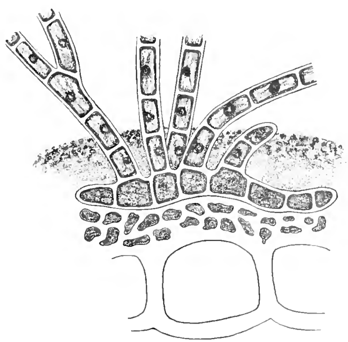


Fig. 53. *Acrochætium Hypneæ* Børgs. Base of a plant. (About 300 : 1).

The sporangia (Figs. 51 *b*, 52) are mostly sessile but some are pedicellate. They occur as a rule upon the lowermost cells of the filaments seriate upon their upper side, but now and then also more scattered.

The sporangia are oblong-elliptic of shape, about 20—22 μ long and 10—11 μ broad.

Found once only in a sheltered locality.

St. Croix: Christiansteds Lagoon.

18. Acrochætium Hypneæ Børgs.

Chantransia Hypneæ Børgs., Some new or little known West Indian Florideæ, I (Bot. Tidsskr., 30. Bd., København 1909).

As pointed out in my former description this species is an endophyte growing upon *Hypnea*. I have examined it again and give now a new figure of the basal part (Fig. 53). As the figure shows the base consists of short horizontal filaments creeping in the thick wall of the host. The cells in these filaments are short, only a little longer than broad, and from these cells the erect sporangiferous filaments grow upwards often several together forming in this way small tufts upon the host.

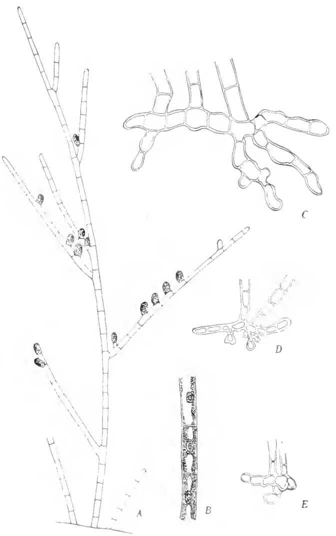


Fig. 54. *Acrochætium Hypneæ* Borgs. *A*, plant with monosporangia. *B*, cells with chromatophore and pyrenoid. *C*, *D*, *E*, basal parts. (*A*, about 125 : 1; *B*, *C*, about 250 : 1; *D*, *E* 200 : 1).

The erect filaments are not very richly branched (Fig. 54); the branches grow out at an acute angle from the mother branch. The ramification is multilateral with some tendency in the upper part to be secund.

The cells are cylindrical, usually 2—4 times as long as broad. They contain a well developed parietal chromatophore (Fig. 54 b) covering nearly the whole wall of the cell and have a large lateral pyrenoid. The sporangia are seriate on the upper side of the branches, sessile or very rarely pedicellate.

If the basal part is left out of consideration it cannot be denied that the above, described *Acrochætium seriatum* shows great likeness to this species. But while the present plant has an endophytic base the other is epiphytic.

This species has been found in a small lagoon with shallow water.

St. Thomas: The Harbour.
Geogr. Distrib.: Danish West Indies.

19. **Acrochætium repens** nov. spec.

Thallus e filis endophyticis et filis sporangiferis erectis compositus.

Fila endophytica irregulariter ramosa sub cellulis epidermalibus hospitis horizontaliter repentia, e cellulis medio plus minus irregulariter inflatis constructa.

Fila erecta, ad 500 μ alta, ramosa, apicem versus sensim attenuata, e cellulis ad basin 7—8 μ latis, superne 2—3 μ latis, inferioribus c. 24 μ longis, superioribus c. 50 μ longis et subhyalinis constructa.

Chromatophorum parietale pyrenoide laterali instructum.

Sporangia oblonga, 14 μ longa et 8 μ lata in ramulis unicellaribus solitaria vel bina, raro sessilia adsunt.

Fig. 55. *Acrochætium repens* nov. spec. Two erect ramified filaments with sporangia and the basal creeping part. (About 300 : 1).

Fig. 56. *Acrochætium repens* nov. spec. *a* and *b*, erect filaments with sporangia. *c*, endophytic, basal filaments seen from above. (About 260 : 1).

This species was found upon a *Gracilaria*-like plant. The endophytic filaments creep below the surface cells of the host (Fig. 55), forming a nearly reticular expansion (Fig. 56 c). The basal filaments are irregularly ramified, consisting of barrel-shaped or more irregularly formed cells more or less swollen in the middle and much tapering towards both ends.

Now and then from these cells erect filaments arise penetrating through the epidermal layer of the host plant (Fig. 55). The erect filaments reach a length of up to 500 μ. Below they are about 7—8 μ thick and the length of the cells about 24 μ. Upwards they taper gradually and end with long nearly colourless hair-like threads; the cells in these threads may reach a length of up to 50 μ or more and are 2—3 μ thick.

The erect filaments are multilaterally or very seldom oppositely ramified and the branches taper in the same way into hair-like ends.

The chromatophore (Fig. 55) is parietal with lobed margin and with a lateral pyrenoid often projecting considerably into the interior of the cell.

The sporangia (Figs. 55, 56 *a*, *b*) are placed at the base of the branches or upon branchlets. They are nearly always pedicellate, but now and then the uppermost sporangium is sessile. The sporangia are oblong, about 14 μ long and 8 μ broad.

Found only once in a sheltered locality in shallow water.

St. Thomas: The Harbour.

20. **Acrochætium phacelorhizum** nov. spec.

Thallus cæspitosus ad 1 mm altus et ultra, e filis endophyticis et filis erectis ramosis sporangiferis compositus.

Fila endophytica inter assimilatores hospitis immersa, sæpe aggregata, in superiori parte ramosa, e cellulis ca. 40 μ longis et 22—25, raro 27 μ latis orta.

Fila erecta, apicem versus sensim attenuata, a basi ramosa. Rami in superiori parte filorum numerosi, sparsi aut sæpe uniseriati.

Chromatophorum parietale pyrenoide laterali instructum.

Monosporangia sessilia, sparsa aut seriata, oblonga, 12—14 μ lata, 22—24 μ longa.

This plant was found upon *Codium elongatum* and *isthmocladum* among the utricles of which the basal part is immersed while the upper free-growing filaments form tufts about 3—4 mm high.

Some small differences were present in my specimens; I shall first describe those found in *Codium elongatum*.

The basal part (Fig. 57) consists of proportionally very thick filaments creeping downwards along the wall of the utricles and between them; in the uppermost end the endophytic filaments are ramified sending downwards from the lower end of the cells

new endophytic filaments while upwards from their upper ends the assimilating and spore-bearing filaments arise. In this way the endophytic filaments form together proportionally dense clusters as most of the filaments run downwards nearly side by side; but now and then also endophytic filaments are found which bend outwards to the side, thus giving rise to new tufts in a similar way to that described by ROSENVINGE for *Acrochætium Nemalionis.* But in *Acrochætium phacelorhizum* it seems to be not so common. The endophytic filaments reach a thickness of up to 27 μ and the length of the cells is about 36 μ. Most often they are thickest at the lowermost end tapering gradually upwards. The wall of the filaments is often somewhat sinuous.

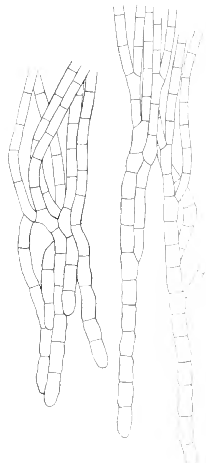


Fig. 57. *Acrochætium phacelorhizum* nov. spec. Two basal parts. (About 100 : 1).

From the upper end of this rhizome-like base the erect filaments arise as mentioned above forming a more or less dense cluster; in a vigorous plant about 4—6 filaments are present; the remnants also of several broken off or dead filaments are often to be found.

The erect filaments (Fig. 58) have spreading branches, in the upper part with some tendency to unilaterality. The filaments are thickest in the lowermost part, about 11—12 μ, tapering very gradually towards their summit, being here about 6 μ thick; these thin ends of the filaments die gradually away. In specimens still in vigorous growth the filaments have blunt ends and do not taper so much. In the lowermost part the cells are about 40 μ long, being mostly a little longer upwards, about 54 μ. The cells are cylindrical and not constricted at the transverse walls. They contain a parietal chromatophore (Fig. 59) with a large pyrenoid protruding considerably into the interior of the cell.

In the specimens found the sporangia were not present in great number. They occur often a few together seriately near the base of the branches but, often also quite scattered (Fig. 58). All the sporangia found were sessile and monosporous, oblong,

about 12—14 μ broad and 22—25 μ long. At the summit of the sporangia a small thickening is often present (Fig. 59).

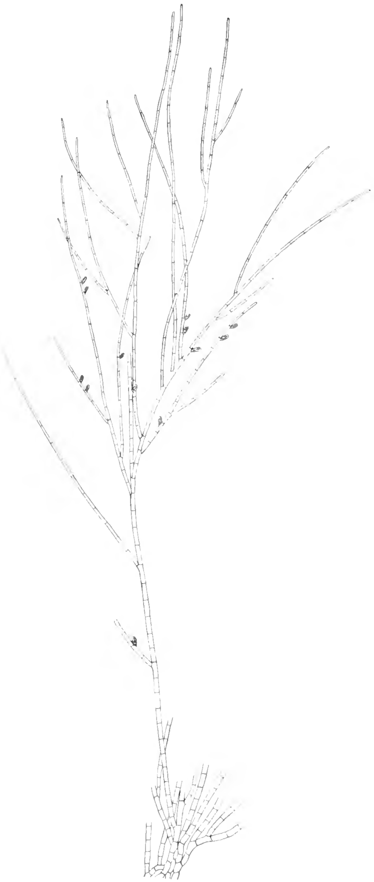


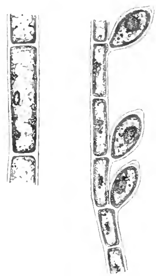
Fig. 58. *Acrochætium phacelorhizum* nov. spec. Uppermost part of the basal part with an erect ramified sporangiferous filament. (About 50 : 1).

The specimens found in *Codium isthmocladum* agreed in all essentials with those described above, but some small differences were noted. Thus the basal endophytic part of the plant was often looser, not so tufted together as shown in the fig. 57 and the endophytic filaments were a little thicker, about 33 μ. Also the erect filaments were somewhat thicker, at their base about 14—15 μ thick, at the apex about 6—7 μ.

Several species of *Acrochætium* occurring upon *Codium* have been previously described. The brothers Crouan have found the *Acrochætium (Callithamnion) Codii*[1]) upon *Codium elongatum*. Of this species Dr. Rosenvinge has ben able to examine original material and has most kindly shown me a fine preparation from which it is clear that my plant has nothing to do with this species. Dr. Rosenvinge will later give a description of this plant.

[1]) Crouan, P. L. et H. M., Florule du Finistère, 1867, p. 135 (nomen nudum). Cfr. Bornet, Deux Chantransia corymbifera Thuret (Bull. Soc. bot. France, Tome 51, 1904, p. XX).

In "Forschungsreise S. M. S. »Gazelle«", IV part, Bot., p. 31 ASKENASY has described the *Acrochætium* (*Chantransia*) *Naumanni* in which the sporangia seem to have a similar thickening of the membrane at their summit as in the present species, but in its whole appearance and in its way of growing, quite or nearly quite immersed in the host plant, it is very different from my plant. The *Acrochætium* (*Chantransia*) *interpositum* Heydrich[1]) must be identical with ASKENASY's species and is in any case highly distinct from my plant. Finally as to *Callithamnion polyrhizum* Harv.[2]), this plant also seems to be very different. Mr. A. D. COTTON has most kindly examined for me a little fragment of the original plant of HARVEY. From this it is evident that HARVEY's plant is much larger and quite different from the mine having much likeness to *Rhodochorton*.



b a

Fig. 59. *Acrochætium phacelorhizum* nov. spec. *a*, filament with sporangia. (About 200 : 1). *b*, cell of the main filament with chromatophore and pyrenoid. (About 250 : 1).

Of species not found in *Codium* our plant has some likeness also with the *Acrochætium* (*Callithamnion*) *Nemalionis* De Notaris of which a very detailed description is given by ROSENVINGE (l. c. p. 126). But *Acroch. Nemalionis* has, as described by ROSENVINGE, "long ramified filaments growing widely in the interior of the host and here and there sending out through the surface of the host free filaments giving rise to new tufts." This I have not found in my plant. And further in *Acrochætium Nemalionis* the sporangia are borne on branchlets while all I have seen in my species were sessile. These differences to which several others can be added show that my plant is very different from that of DE NOTARIS.

This species has been found at the shores of St. Croix: Coakley Bay (in *Codium isthmocladum*) and St. Jan: Off America Hill (in *Codium elongatum*).

21. **Chantransia Liagoræ** nov. spec.

Fila vegetativa endophytica inter filamenta assimilatoricis hospitis repentia, parce ramosa, ramis sparsis, ramulis brevibus instructis.

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1) HEYDRICH, F., Vier neue Florideen von Neu-Seeland (Berichte d. deutschen bot. Gesellschaft, Bd. 11, 1893, p. (78), pl. XXII, fig. 8).

2) HARVEY, W. H., Phycologia Australica, vol. V, 1863, p. LVI; compare also J. AGARDH, Epicrisis, 1876, p. 12.

Cellulæ subcylindricæ, dolioformes, medio plus minus inflatæ vel interdum magis irregulares, 8—14μ latæ, ca. 35μ longæ, chromatophorum stellare, pyrenoide centrali instructum continentes.

Pili hyalini terminales, non numerosi, adsunt.

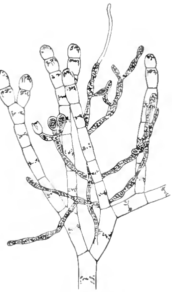

Fig. 60. *Acrochætium Liagoræ* nov. spec. Part of a plant between the assimilating filaments of Liagora. (About 120 : 1).

Sporangia, sessilia aut pedicellata, singula vel interdum bina, globulose-obovata, ca. 20μ longa et ca. 14μ lata.

This species was found abundantly in *Liagora pinnata.* It creeps among the assimilating filaments in the mucilage and chalk coating found here (Fig. 60).

The filaments are not particularly branched and rather long intervals occur which have no branches at all; in some parts of the filaments on the other hand branchlets are given off from the outer side of nearly each cell in the filaments (Fig. 61). Sometimes these branchlets are repeatedly ramified; it also happens occasionally that two branchlets arise from the same cell. These branchlets bear the monosporangia, but sessile sporangia placed immediately upon the cells of the main filaments are not uncommon.

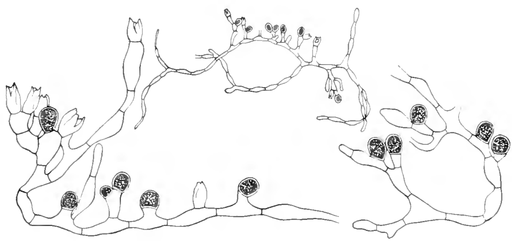

Fig. 61. *Acrochætium Liagoræ* nov. spec. Parts of three plants with sporangia (some ones emptied). (About 75 : 1 and 200 : 1).

The cells in the main filaments are irregular in shape, mostly somewhat swollen in the middle tapering towards both ends; in the middle their diameter reaches a length of about 16μ, at the ends about 8μ; their length varies about 35μ.

The chromatophore (Fig. 62) is stellate with long strands run-

ning along the walls of the cells; in their middle a well developed pyrenoid is present.

The cells in the ends of the filaments bear now and then thin hyaline hairs (Figs. 60, 62); these are about 5,5 μ thick and reach a length of about 300—400 μ.

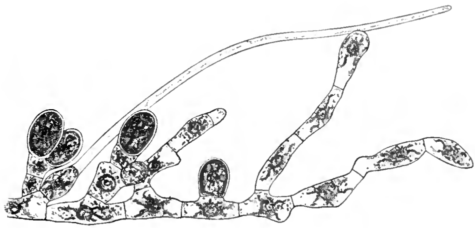

Fig. 62. *Acrochætium Liagoræ* nov. spec. Part of a plant with sporangia and hair. (About 400 : 1).

As mentioned above the monosporangia are developed in the end of the branchlets or more rarely upon the main filaments; they are obovate-globular of shape, about 20 μ long and 14 μ broad.

Of the species mentioned by ROSENVINGE I think it comes nearest to *Acrochætium* (*Chantransia*) *Polyidis* Rosenv.

This species has only been found once at the south coast of St. Croix.

22. **Acrochætium crnothrix** nov. spec.

Thallus cæspitulosus, ca. 400 μ altus. Pars basalis non certo observata est. Fila erecta a basi ramosa. Rami principales stricti, in inferiori parte paucis, in superiori numerosis ramis et ramulis instructi.

Cellulæ ramorum 5—6 μ latæ et 15—18 μ longæ, cylindricæ, chromatophorum zonatum prolongationibus irregularibus instructum et pyrenoide centrali munitum continentes.

Ramuli sporangiferi e 2—3, rarius pluribus cellulis compositi, ad apicem versus angustati in pseudopila longa producti. Monosporangia sessilia aut pedicellata, lateralia 2—3 seriatim posita, rarius terminalia, ovato-oblonga, 8—10 μ longa et 5—6 μ lata.

Of this characteristic species I have only succeeded in finding a single specimen. It was growing upon a *Centroceras*-plant forming a small tuft.

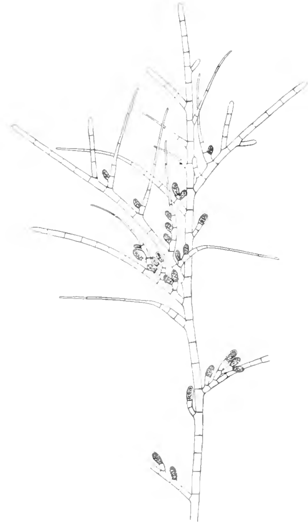

Fig. 63. *Acrochætium ernothrix* nov. spec. Erect ramified filament with sporangia-bearing branchlets ended with hairs. (About 150 : 1).

As to the base I much regret that I have not been able to state with certainty how it is formed having only had a single specimen. By means of chlorzinc jodine, which coloured the *Acrochætium* and at the same time had a clearing influence upon the tissue of the host plant, I have arrived at the conclusion that the base most probably consists of a few creeping filaments somewhat immersed in the tissue of the host plant.

From this basal part an erect filament arises which immediately begins to give off branches forming in this way a small tuft about 400 μ high. The principal filaments are rather straight (Fig. 63); they branch out in all directions along their whole length but mostly in the upper part. They consist of cells about 5—6 μ broad and 15—18 μ long.

The chromatophore (Fig. 64) is bandshaped often with more or less long prolongations along the wall of the cell; in the middle a large pyrenoid is present.

The branches are of two kinds, short sporangia-bearing branchlets (Fig. 64) and ordinary branches growing out to filaments like the principal filaments and again branched in the same way.

The branchlets have a very characteristic appearance (Fig. 64). They consist of two or three, rarely more, cells the uppermost of which taper greatly and runs out in a long hair-like prolongation composed of two or three,

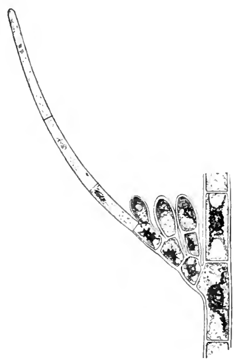

Fig. 64. *Acrochætium ernothrix* nov. spec. Branchlet with sporangia and hair. (About 350 : 1).

thin, nearly colourless cells. The whole length of the branchlet is about 80—100 μ. The hair-like prolongations have a length of about 50 μ and are about 1—2 μ thick in the summit.

Upon the lowest cells of these branchlets we find a single or mostly two or three serially disposed sporangia (Figs. 63, 64). The lowermost sporangia are often pedicellate, the others sessile. Rarely sporangia are found terminally upon short two- or three-celled branchlets.

The sporangia are ovate-oblong, 8—10 μ long and 5—6 μ broad.

This species was gathered in a sheltered locality behind Long Reef at Lt. Princess, St. Croix.

Subfam. 2. Nemalieæ.

Nemalion Targioni Tozzetti.

1. **Nemalion Schrammi** (Crn.) Børgs.

Børgesen, F., Some new or little known West Indian Florideæ, I (Botanisk Tidsskrift, vol. 30, 1909, p. 4, pl. 1).

Helminthocladia Schrammi Crn. (nomen nudum) in Mazé et Schramm, Algues de la Guadeloupe, 2e Edit., Basse-Terre 1870—7, p. 177.

On the south side of St. Croix I have found some few but large and well developed specimens of a *Nemalion* which I in my above mentioned paper have referred to *Helminthocladia Schrammi* Crn.

For details I refer to the above mentioned paper and shall here only give a description of the plant.

The specimens when living had a very gelatinous surface so that they slipped out of one's hand like an eel; on the other hand the consistency was rather tough. The colour was a dark redbrown. The thicker main branches which reach a thickness of about $1^1/_2$ cm were somewhat compressed, the thinner nearly terete. The surface was smooth in places, being somewhat curled or crisp especially in the thicker branches.

On drying they adhere strongly to the paper and gradually take on a dirty, yellow-brown colour.

The plant was fastened to stones and shells on the bottom by means of a small roundish disc at the base.

The specimens are irregularly ramified on all sides, often too with numerous proliferations at the apices (cfr. l. c. plate 1).

The middle of the thallus consists of a tissue of colourless, rather poorly ramified, cell-threads which are loosely interwoven (Fig. 65 *E*); the cell-threads are from 2 to 12 μ thick and consist of rather long and thick-walled cells.

Towards the periphery these hyphæ-like cell-threads are more richly ramified and here pass evenly into the radially placed assimilating filaments, which are arranged in small groups (Fig. 65 *A*). They are dichotomously divided, moniliform, consisting of oval cells which are about 28 μ long and of about half that in breadth.

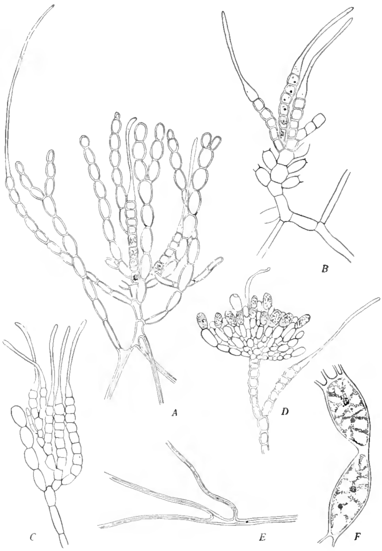

Fig. 65. *Nemalion Schrammi* (M. et S.) Børgs. *A*, assimilative filaments with two carpogonial branches (*A*, 140 : 1). *B* and *C*, groups of carpogonial branches. (*B*, 160 : 1, *C*, 140 : 1). *D*, cystocarp with decayed trichogyne (140 : 1). *E*, colourless cells from the middle of the thallus (140 : 1). *F*, Two assimilative cells with chromatophore, pyrenoid and nucleus. (250 : 1).

In the upper end of the cell lies the chromatophore, but often it fills up also more or less the whole cell; it is irregularly star-like, consisting of numerous strands which radiate from the centre of the cell in all directions (Fig. 65 *F*); when these strands meet each other at the periphery of the cell they grow together and form a clathrate layer with large and numerous openings within the cell-wall. In the central body of the chromatophore a pyrenoid is present which was densely stained by means of hæmatoxyline. The structure of the chromatophore seems thus to be in good agreement with that of *Nemalion multifidum* according to Wolfe's description ("Annals of Botany", vol. XVIII, 1904, p. 610) with the exception that he has not found a pyrenoid in his material. And further it also seems to agree well with that

of *Nemalion lubricum* according to the statement of L. Kurssanow in "Flora", 99. Bd., 1909 p. 311. It is here pointed out in accordance with the opinions of earlier investigators and in contradiction to Wolfe's statement that a pyrenoid is present in the middle of the chromatophore.

Rarely the vegetative cells terminate in a rather long hair (Fig. 65 *A*).

Most often the main cell-thread in the middle of the above mentioned groups of assimilating-filaments terminate in a carpogonium and further also often 2—4 or more side-branches likewise bear terminal carpogonia (Fig. 65 *A*). Fig. 65 *C* shows a branch dichotomously divided, in which the branches terminate in a carpogonium.

The carpogonial branch is composed usually of 4 cells, but sometimes only 3 occur, occasionally even 5. This is in agreement with *Nemalion multifidum* where the number of cells also is somewhat variàble. Bornet and Thuret [1]) give the number to be 3—4, Janczewski [2]) indicates it to be composed of 3 cells and Wolfe (l. c., p. 613) writes: "This carpogonic branch is composed usually of three cells; since, however, the number varies from two, in the simplest noted, to as many as five, it cannot be considered as in any way significant". A well developed nucleus was found in each of the cells of the carpogonial branch (Fig. 65 *B*); on the other hand the chromatophore was not very conspicuous even if it was not quite absent as Janczewski describes it. The cells of the carpogonial branch are roundish-subquadrangular and usually a little shorter and thicker than the vegetative cells in the lowest part of the cell-thread. By means of this they are also most often easily recognisable though I must confess that it may sometimes be difficult to decide where the carpogonial branch begins and the vegetative cells end, as Wolfe has also pointed out in this way concerning the carpogonial branch of *Nemalion multifidum* (l. c. p. 613): "The lowest cell of the series partakes to some extent of the characters of both, and thus lessens the abruptness of the transition between the two types".

The carpogonium bears a rather short and often somewhat bent trichogyne which is swollen towards its apex. In spite of

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[1]) Bornet, E. et G. Thuret, Recherches sur la fécondation des Floridées (Ann. sc. nat. Botanique, V. sér., t. 7, 1867 p. 141).

[2]) Janczewski, E., Notes sur le développement du cystocarpe dans les Floridées. (Mém. de la Soc. Nat. d. Sc. Nat. de Cherbourg, vol. XX, p. 109).

much search I have not succeeded in finding antheridia; occasionally some decayed fragments of what perhaps might be remains of antheridia were found at the tips of the filaments, but it seems to me very doubtful what they really were. Most probably the specimens are dioecious in accordance with what Rosenvinge (l. c. p. 146) has stated to be commonly thecase with *Nemalion multifidum* in the Danish waters. I have never seen spermatia in contact with the trichogyne.

Nearly all the material at hand was found in this stage of development. In the youngest tips of the plant only were no carpogonial branches yet developed. After much search and by taking samples in different parts of the dried material I have however found a few cystocarps of which fig. 65 *D* illustrates one. If these are normally constructed, the sporogenous filaments seem to be more loosely connected than those in *Nemalion multifidum*. The carpospores are about 11 μ broad.

This species was found in shallow water fixed to stones and shells near the shore. The locality was rather sheltered; but nevertheless small waves occur by which the plant was moved to and fro.

Only collected once in the month of February on the south coast of St. Croix: at Long Point.

Geogr. Distrib.: West Indies.

2. Nemalion longicolle Børgs.

Børgesen, F., Some new or little known West Indian Florideæ, I. (Botanisk Tidsskrift vol. 30, 1909, p. 8, pl. 2).

This species was growing together with the preceding one which it very much resembled in colour and outer habit. For this reason I did not observe when collecting the plant that it was different from *N. Schrammi* and I have therefore unfortunately not preserved it in any other form than dried.

It was only during the microscopical examination here in Copenhagen that it became clear that my material contained two forms and after having arranged them in accordance with the different microscopical characters they then showed quite plainly a difference in habit also.

Thus the specimens (l. c., plate 2) when compared with *N. Schrammi* were found to be more slender, the thickest branches being 5—7 mm thick. They were richly subdichotomously or laterally ramified and the thallus had not the crisp folded surface to be found in *N. Schrammi*. The colour of the dried spec-

imens was red-brown in contrast to the more dirty yellow-brown in *N. Schrammi.*

As to the anatomical structure, this species consists in the interior of nearly colourless, long-celled, hyphæ-like, thick-walled cells running mostly in a vertical direction, interwoven and from 3—14 μ thick. Near the periphery they are more richly ramified and bear here the horizontal assimilating filaments which radiate outwards in small bundles and branch dichotomously (Fig. 66 *A*). Innermost at the transition from the medullary tissue the cells are rather long and nearly cylindrical but they grow soon shorter and at the same time become swollen in the middle in such a way that the cell-threads become moniliform, reaching a thickness of about 13—14 μ. Compared with *N. Schrammi* the cells are somewhat slender.

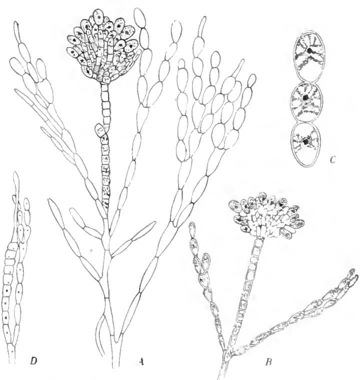

Fig. 66. *Nemalion longicolle* Borgs. *A*, bundle of assimilative filaments in the middle of which the cystocarp (140 : 1). *B*, another cystocarp (140 : 1). *C*, cells with chromatophore and pyrenoid (250 : 1). *D*, carpogonial branch with trichogyne (140 : 1).

The chromatophore (Fig. 66 *C*) is stellate and resembles very much that of *N. Schrammi* though as a general rule it only fills half the cell; of the outermost ones nearest to the periphery it occurs at the top, while it is found in about the middle of the slender and more cylindrical cells further in. In the middle of the chromatophore a pyrenoid is present. Having only dried material for examination I have not succeeded in finding the nucleus.

In the middle of each of the peripheral bundles of assimilating filaments a single cystocarp occurs (Fig. 66 *A*, *B*); it is very rarely that a second one develops on a side-branch.

While in *N. Schrammi* nearly all the material was in the stage of development mentioned above, viz. with the trichogynes still present, in *Nemalion longicolle* nearly all the material had ripe cystocarps. These are terminally placed on a rather long straight branch, the cells of which are shorter and nearly cylindrical,

grading rather evenly over into the cells belonging to the carpogonial branch; sometimes also as shown in fig. 66 *A* the growth of the branch has stopped and a side-branch has then grown out as a prolongation of the mother-branch bearing the cystocarp. The carpogonial branch is composed of 4—6 cells; these are shorter than the vegetative ones and contain only a slightly developed inconspicuous chromatophore or only remains of it. The cell-walls of the carpogonial branch are distinctly stained by hæmatoxyline. The cells in the carpogonial branch are about 9 μ thick. In the youngest tips of the plant some younger carpogonial branches occurred and a few with trichogynes still preserved were found in the older part of the thallus perhaps because they had not been fertilized; the trichogyne had nearly the same form as in *N. Schrammi*, growing thicker towards the tip (Fig. 66 *D*).

The carpospores were about 14 μ long and 11 μ broad.

As to the outer habit, I may add that near the base the thallus grows at first thinner but finally it broadens out again to a small disc, by means of which the plant is fastened to stones and shells on the bottom.

The plant was growing in shallow water quite near the shore in rather sheltered localities where it swings to and fro following the feeble motion of the sea. It was collected in the middle of February having at that time ripe or nearly ripe cystocarps.

Only found once on the southern coast of St. Croix: at Long Point.

Liagora Lamour.

As is well known J. Agardh has given a survey of the anatomical structure of the species of *Liagora*. The title of his paper is: "De differentiis in structura frondis, quæ in diversis *Liagoræ* speciebus observantur" (in "Analecta Algologica", Continuatio III, Lund 1896, p. 96). This paper does not seem to be quite satisfactory most probably because J. Agardh had not sufficient material and has based his description exclusively upon dried material. Several of his species seem to be so closely related that they most probably belong to one another being forms of the same species. In any case it is not always an easy task to determine by means of J. Agardh's description a *Liagora*-specimen. A monograph of this genus would certainly be of much use. Zeh[1]) has promised such a work, but up till now he has merely

[1]) Zeh, W., Neue Arten der Gattung Liagora (Notizblatt des Königl. botanischen Gartens und Museums zu Berlin. Band V, 1913, p. 268).

given short diagnoses of some new species, which has only added to the difficulties. Having now examined my West Indian material of this genus I have found that good characters are present not only in the shape of the assimilating filaments but also in that of the carpogonial branch, of the antheridia and the cystocarps. In the last mentioned, especially, the filaments surrounding the sporogenous filaments are very differently developed. In the specimens which are not easily recognizable by means of the external habit, e. g. ramification, calcification etc., these characters of internal structure might be of great assistance.

Judging from the description of BUTTERS [1]) *Liagora* reminds one much of *Trichogloea*, the essential difference is that the carpogonial branch is lateral in *Liagora*, and terminal in *Trichogloea*.

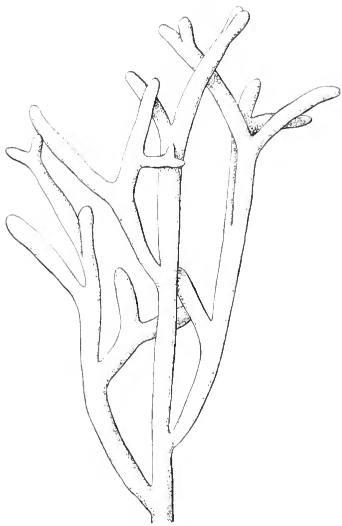

Fig. 67. *Liagora elongata* Zanard. Part of a plant. (About 3 : 1).

1. Liagora elongata Zanard.

ZANARDINI, G., in Flora, vol. 34, 1851, p. 35; Plant. in Mari Rubro... (Memorie Istituto Veneto, vol. VII, 1857, p. 274, tab. 6, fig. 1). KÜTZING, F., Tabulæ Phycol., vol. VIII, 1858, pl. 94 II. AGARDH, J., Epicrisis, p. 516; Analecta Algologica, Contin. III, p. 105.

As pointed out by J. AGARDH (l. c. p. 105) this species is characterized by the fact that the cells in the robust assimilating filaments (Figs. 68, 69 *a*) have nearly the same breadth through their whole length and further that the cells are seldom longer than double their diameter. The assimilating filaments are not much ramified; the branches arise mostly at an acute angle from the mother filaments and are all straight or nearly so.

[1]) BUTTERS, FR. K., Observations on Trichogloea lubrica. (Minnesota Botanical Studies, Third Series, Part I, 1903, p. 11).

The lowermost cells in the assimilating filaments are larger and often somewhat irregularly shaped; their breadth is about 40 μ; higher up the cells grow thinner, about 17 μ and keep this diameter almost until the apex. The whole assimilating filament reaches a length of about 400—500 μ.

The medullary cells are large subcylindric-barrelshaped, their diameter reaching a length of up to 150 μ or more and the whole length of the cells about ten times the breadth. With a trans-

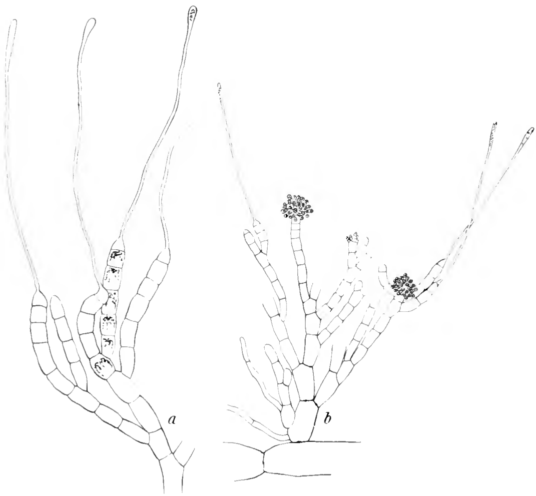

Fig. 68. *Liagora elongata* Zanardini. *a*, assimilating filaments with hairs and (*b*) with antheridia. (*a*, about 140 : 1, *b* 60 : 1).

verse section (Fig. 70) one sees that they are not lying close together in any case not after decalcification, but imbedded in mucilage, and in this irregularly bent thin filaments run in all directions; these last mentioned filaments consist of long nearly cylindrical cells, the diameter of which is about 8—10 μ and their length about 10 times the breadth. These thin filaments have their origin from the large basal cells in the assimilating filaments.

From nearly all the summits of the young assimilating filaments long hairs arise (Fig. 68); these are about 5 μ thick, in their uppermost somewhat swollen end about 8 μ and reach a

length of about 250 μ. They are quite hyaline with the exception of the uppermost end which is almost entirely filled with protoplasm.

The calcareous layer is rather thick, but uneven and loose; it extends from the medullary tissue to about the upper third part of the assimilating filaments which are free and protrude freely together with the antheridia and hairs found here.

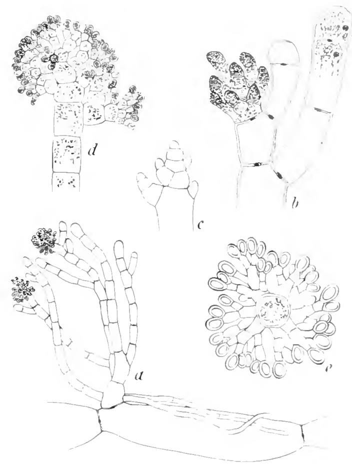

Fig. 69. *Liagora elongata* Zanard. *a*, medullary cell with assimilating filaments and antheridia. *b* and *c*, development of antheridia; *d*, *e*, nearly ripe antheridia, *e*, in transverse section. (*a*, about 60 : 1, *b*, *c*, *d*, *e* about 300 : 1).

The antheridia (Fig. 69) are found on the summit of the assimilative filaments and form dense hemispherical or pyramidal clusters. The development of the antheridia takes place as follows (Fig. 69): The end of an assimilating filament which is at the same time rich on contents is prolongated conically and divided by transverse walls into several small cells; from these again small conical outgrowths arise on all sides which soon are divided by transverse walls (Figs. 69 *b*, *c*) giving rise to small branches. These are repeatedly di—trichotomously branched into several small branchlets, the end cells of which are the antheridia (Fig. 69 *e*).

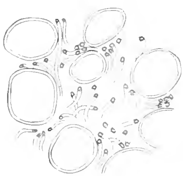

Fig. 70. *Liagora elongata* Zanard. Transverse section of medullary tissue. (About 60 : 1).

In the material collected I have only found antheridial plants; so I cannot give any information as to the carpogonial branch or cystocarp.

Forms of this species have been frequently referred to the Australian plant *Liagora Cheyneana* Harv., a species which also shows not a little likeness to *Liagora elongata*.

This species has been found in the month of February near the shore in shallow water in a somewhat exposed place.

St. Croix: Long Point.
Geogr. Distrib.: Red Sea, Mauritius, Florida, West Indies.

2. **Liagora corymbosa** J. Ag.

Agardh, J., Analecta Algologica, Contin. III, 1896, p. 104.

Of this plant I have had only a single dried specimen at my disposal. This specimen agrees well with the few found in J. Agardh's Herbarium at Lund.

The plant has a rather characteristic appearance; it is reddish brown when dry and has a very scabrous surface which examined under a lens is found to be composed of dark red and whitish dots. The ramification is irregularly dichotomous with numerous prolifications, the branches spreading out at nearly right angles.

Having had only dried material I shall not enter upon a more detailed description of the anatomical structure but only point out that it seems to agree closely with that of *L. elongata*. The cells in the assimilating filaments are nearly cylindrical or a little barrel shaped, about 2—3 times as long as broad and about 17 μ thick. The antheridia also seem to agree exactly with those of *L. elongata*. Most probably therefore this species is only a variety of that plant. Zeh, who has had the material in the Botanical Museum, Copenhagen, for determination, has named the specimens of this alga as *L. elongata*.

This plant has only been collected as washed ashore material and was sent to me by Dr. Hamburger.

St. Croix: Sandy Point.
Geogr. Distrib.: Florida, Bermudas.

3. **Liagora valida** Harv.

Harvey, W. H., Nereis Bor.-Am., Part II, 1853, p. 138, tab. 31, A. Agardh, J., Epicrisis, p. 517; Analecta algologica, Contin. III, p. 107. Kützing, F., Tab. Phycolog., vol. VIII, pl. 92 I.

This species was originally described on specimens from Florida, and judging from Harvey's clear description my specimens seem to agree well with them. The plant is characterised by having a terete frond (about 1 mm thick) which is fairly regularly dichotomous. The calcareous coating is quite continuous giving the plant an even surface and when dry a whitish colour;

only in the summits of the frond is it not so complete allowing the red-brown tips of the assimilating filaments to protrude. Also the cystocarps project above the calcareous layer and are seen in the fruiting specimens as dark red dots (comp. fig. 71).

The assimilating filaments have, as pointed out by J. AGARDH, a corymbiform outline (Fig. 72). They reach a length of about 200 μ or somewhat more. They are 4—5 times repeatedly forked. The uppermost cells are pearshaped or broad oval, about 10—12 μ thick (Fig. 73 *b*); lower down in the filaments the cells grow longer, at length becoming subcylindric. The lowermost cells are about 16 μ thick.

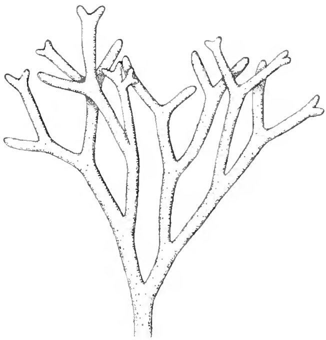

Fig. 71. *Liagora valida* Harv. Part of a plant. (About 3 : 1).

The central filaments consist of subcylindric cells somewhat tapering towards the ends (comp. figs. 72 and 74 *a*); they are about 20—40 μ thick or more, and often reach a length up to 20 times their own diameter. They have very thick walls. Between these thicker filaments run thinner ones (lat. about 8 μ), as the transverse section of the medullary tissue shows (Fig. 74).

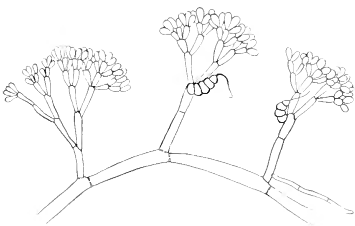

Fig. 72. *Liagora valida* Harv. Assimilating filaments with carpogonial branches. (About 60 : 1).

These thin filaments originate from the lowermost cells in the assimilating filaments (comp. fig. 75 *a*). They run between or creep along the medullary filaments; and from those near the surface erect filaments arise (comp. fig. 73 *a*). They are somewhat branched and consist of oval cells; they grow up between the assimilating filaments. As they have well developed chromatophores they may be considered as a kind of secondary assimilating filaments.

The carpogonial branch is borne upon one of the cells in the

middle of the assimilating filaments (Fig. 72). Besides the carpogonial cell with the trichogyne it consists most commonly of 4 cells (Fig. 75 *b*), sometimes of 3 only. The branch is comparatively thick, the diameter reaching often a length of 22 μ. After fecundation the carpogonial cell is divided by a transverse wall into two cells from the uppermost of which the sporogenous filaments grow out (Fig. 75 *a*), while the lowest remain undivided.

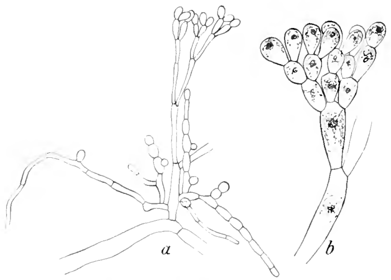

Fig. 73. *Liagora valida* Harv. *a*, assimilating filament (comp. the text). *b*, Part of a filament showing shape of the cells. (*a*, about 60 : 1; *b*, about 160 : 1).

The cystocarp (Fig. 75 *c*) is a comparatively large spherical body which reaches often more than 400 μ in diameter. It consists of thin sporogenous filaments (lat. about 8 μ); these are ramified, more or less woven together and composed of rather long nearly subcylindrical or more irregularly shaped cells. At the end of the filaments the carpospores are produced (Figs. 75 *d*, *e*); these reach a length of about 10 μ while their diameter is about 5—6 μ. After the fertilization of the carpogonium several ramified filaments arise from the cell below that upon which the carpogonial filament is inserted. These pericarpic filaments consist of thicker, oval, often nearly spherical, sometimes also more irregularly shaped cells; they grow upwards around the cystocarp. Furthermore from the basal part of these cells and also from the sporogenous filaments thin hair-like filaments grow downwards often in great numbers (Fig. 75 *c*).

Fig. 74. *Liagora valida* Harv. Transverse section of the medullary tissue. (About 60 : 1).

The antheridia I have not found in my material; on the other hand they were present abundantly in a specimen from Key West, (Farlow, Andersson & Eaton, Alg. Am. Bor. exsicc., no. 70) in Herb. J. Agardh in Lund. The antheridia are found on the summits of the assimilating filaments whose uppermost cells are divided into thin filaments in the end cells of which the spermatia are developed.

Liagora tenuis J. Ag. seems to come very near to this species judging from the few specimens upon which J. Agardh based his description. Compared with *L. valida* the thallus seems to be a little thinner, but except for this not very essential difference they are very alike. Of one of the specimens, collected at Florida by Miss Curtiss a small piece was examined; it had the assimilating filaments less ramified than in *L. valida* and the filaments had not the corymbiform outline, but to decide how far these differences are other than casual development much more material is necessary.

Liagora annulata J. Ag. also seems to come near to *Liagora valida*; indeed, most probably, it is only a variety of this species; a supposition I have confirmed by the fact that in some of my specimens now and then a rudimentary annulation is present. But to settle this question rich material is necessary. In his paper, "Notes on Bahaman Algæ[1]", Howe considers it as a distinct species.

Fig. 75. *Liagora valida* Harv. *a*, assimilating filament with young cystocarp, *b*, carpogonial branch, *c*, cystocarp with surrounding filaments, *d*, *e*, sporogenous filaments with carpospores. (*a* and *c* about 60 : 1; *b*, *d*, 160 : 1; *c*, 140 : 1; *e*, 250 : 1).

Liagora valida has been collected with ripe carpospores in January and February. It grows in shallow water in the upper sublittoral region and in somewhat sheltered places.

St. Croix: At White Bay near the south west end of the island and at Coakley Bay upon the north side.

Geogr. Distrib.: West Indies, Madagascar.

[1]) Bulletin of the Torrey Bot. Club, vol. 31, 1904, p. 99.

4. Liagora pinnata Harv.

Harvey, W. H., Nereis Bor.-Americana, part II, 1853, pag. 138. Agardh, J., Epicrisis, 1876, pag. 517; Analecta Algologica, Contin. III, 1896, p. 108.

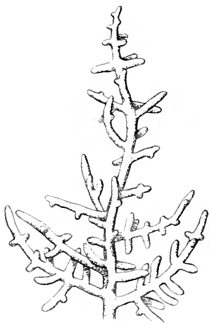

Fig. 76. *Liagora pinnata* Harv. Part of a plant. (About 3 : 1).

The plants (Fig. 76) I have referred to this species seem to accord well with the description and figures of Harvey (l. c.) even if they show some differences.

Harvey describes the frond as three inches long; my specimens reach a length of up to 16 cm. The stems are set at short intervals with branches, spreading out on all sides longest in the middle of the frond, shorter upwards and downwards. These branches bear again branchlets placed in the same manner and the branchlets again ramuli. Harvey says that the ramuli are "often opposite" but this does not agree with my observations.

For the rest I refer to Harvey's good description of the dried plant; his comparison of the very uneven surface with "pepper and salt" is very striking, darker red-brown dots protruding over the whitish coating originating from the upper end of the assimilating filaments and cystocarps.

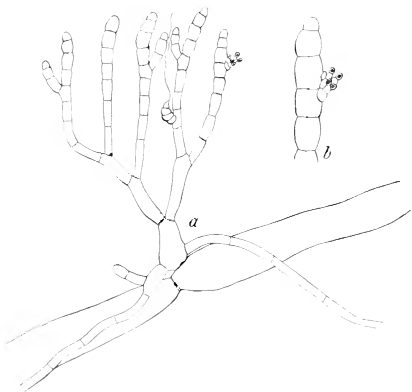

Fig. 77. *Liagora pinnata* Harv. *a*, assimilating filament with carpogonium and antheridia, *b*, part of an assimilating filament with antheridia (*a*, about 60 : 1; *b*, 160 : 1).

The central nearly or quite colourless filaments in the thallus consist of long more or less cylindrical cells tapering usually somewhat near their ends (Fig. 77 *a*); these cells are about 50 μ thick and about 8 times their own length; but some

occur which reach more than 100 μ in diameter; besides these cells there are many of a much more irregular form.

The assimilating filaments (Fig. 75 *a*) consist at their base of nearly cylindric cells about 40 μ thick and 2—3 times as long as broad. The filaments branch several times (4—5 or more) the cells at the same time becoming gradually thinner, the thinnest being found somewhat over the middle of each cluster of filaments; then they grow thicker again until near the top where they suddenly narrow conically. In the cluster of filaments represented in fig. 77 *a* the cell at the base is 40 μ thick, the thinnest cells in the middle of the cluster are 11 μ and the thickest near the top 25 μ.

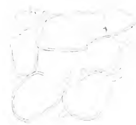

Fig. 78. *Liagora pinnata* Harv. Transverse section of medullary layer. (About 60 : 1).

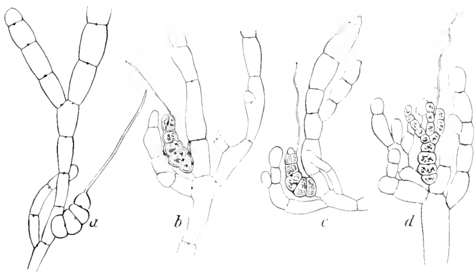

Fig. 79. *Liagora pinnata* Harv. *a*, carpogonial branch, *b*, *c*, *d*, development of the cystocarp, (*a* and *b*, about 160 : 1, *c* and *d* 150 : 1).

From the basal cell, and sometimes also from other of the lower cells in the cluster of assimilating filaments, rhizoidal filaments grow out along the central large filaments (77 *a*). These rhizoidal filaments consist of long more or less cylindrical or somewhat inflated cells; from these erect filaments grow up the cells of which are shorter but often rather thick, oval or rather irregularly inflated, the filaments in this way getting a somewhat moniliform appearance; these filaments become intermingled between the assimilating filaments of the periphery.

Somewhat below the middle in the cluster of the assimilating filaments we find the carpogonial branch (Fig. 77 *a*). This is placed laterally upon one of the cylindrical cells found here, and

is as a rule composed of four cells: three cells and the carpogonium with a rather long thin trichogyne (Fig. 77 *a*). After fertilization the carpogonium is divided by a transverse wall into a basal cell, which as is the case in *Nemalion* and *Helminthora*, remains undivided, and an upper cell. This cell is firstly divided by a more or less vertical wall into two cells, after which variously orientated walls arise (Fig. 79 *b*, *c*, *d*), the

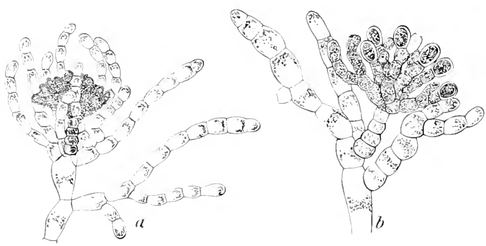

Fig. 80. *Liagora pinnata* Harv. Cystocarps, *a*, with surrounding filaments, *b*, showing carpospores. (*a*, about 60 : 1, *b*, 150 : 1.)

result of which is a cluster of irregularly bent, ramified filaments (Fig. 80 *a*). These are the sporogenous filaments whose cells at the end of the filaments produce the carpospores (Fig. 80 *b*). When ripe these are oval or obovate, about 15 μ broad and 18 μ long.

As a secondary result of fertilization sterile filaments begin to grow out from the cell immediately below the cell in the assimilating branch upon which the carpogonial branch is found. These filaments grow up round the cystocarp forming a kind of covering about it but only very loose and imperfect (Fig. 80 *a*).

Fig. 81. *Liagora pinnata* Harv. Antheridia. (About 170 : 1).

The antheridia (Fig. 81) are found in the same plant as the carpogonial branch and often in the same assimilating filament (Fig. 77 *a*). They are placed at the summit of short branchlets growing out from one of the cells somewhat below the top of the assimilating filaments (Fig. 77 *b*). From the upper end of these branchlets ramified filaments, consisting of rather short cells grow out forming dense, nearly hemispherical clusters. The terminal

cells of these branchlets are the mother-cell of the spermatia. The cells have a rather thick wall and are when ripe about 3—4 μ in diameter.

This species was found in rather exposed localities down to a depth of about ten meters, It was collected in the months January and February and was in a fructifying condition.

St. Croix: White Bay, and near Buck Island in a depht of about 5 fathoms.

Geogr. Distrib.: Florida, West-Indies.

5. **Liagora megagyna** nov. spec.

Frons cæspitosa, 12—14 cm alta, teres, e basi sensim vix attenuata, irregulariter ramosa, ramis inferioribus longioribus, superioribus brevibus ramulos parvos obtusos irregulariter dispositos gerentibus.

Crusta calcarea in specimine exsiccata farinaceo-scabrida.

Axis centralis ex filamentis crassioribus cellulas subcylindrice-dolioformes continentibus et filamentis tenuioribus, compositus est.

Stratum periphericum ex filamentis dichotomis, cellulas subcylindricas ad apicem versum oblonge-ovales continentibus compositum est.

Rami carpogonii robusti, recti aut fere recti, ex 3—5 cellulis brevibus compositi. Cellula carpogonica breviter conica in trichogynum longum cylindricum producta. Cystocarpia fere sphærica ex filis carposporiferis composita, plus minus filamentis sterilibus, ex cellulis infra ramos carpogonii ortis, circumcincta.

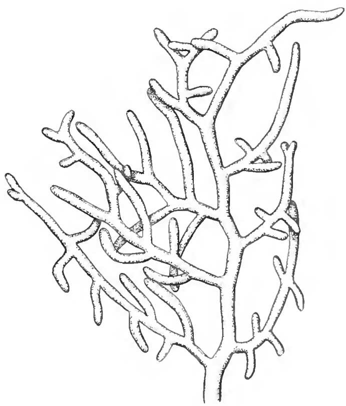

Fig. 82. *Liagora megagyna* nov. spec. Part of a plant. (About 3 : 1.)

The ramification of this species is very irregular, sometimes apparently monopodial, sometimes more or less dichotomous with many proliferations (Fig. 82).

The frond is terete and the calcification well developed forming a continuous covering; only at the summits of the branches

is the calcification nearly wanting. The surface is glabrous, in dried specimens uneven or dotted.

Fig. 83. *Liagora megagyna* nov. spec. *a*, *b*, *c*, *d*, assimilating filaments with carpogonial branches and hair-like filaments. *e*, ends of assimilating filaments with remnants of died cells. *f*, *g*, end of assimilating filaments with short hairs. (*a*, *b*, *d*, about 60 : 1, *c*, *e*, *f*, *g*, about 160 : 1.)

The fascicles of assimilating filaments (Fig. 83 *a*, *b*, *c*) are proportionally large and richly ramified. The lowermost cells in each fascicle are large, somewhat swollen upwards, but very variable in size, their diameter often reaching a length of 40 μ or more.

From these basal cells 2—3 or more filaments grow upwards; these are several times di- or trichotomously divided. The lowermost cells in these filaments are subcylindrical or nearly so; after each division the cells grow thinner and also shorter until about the middle of the whole branch system where the cells on an average are only 10—15 μ thick. From here the cells again get thicker and at the same time also shorter, nearly oval, the ends of the assimilating filaments in this way getting a moniliform appearance. The cells in the upper part of the assimilating fila-

ments are about 19—20 μ thick and 30—35 μ long. The whole fascicle reaches a length of up to 500—600 μ.

Peculiar hairlike organs arise everywhere in the filaments (comp. Fig. 83 *a*, *c*, *d*). These are short, consisting of a single cell only, or longer, sometimes ramified, and composed of cylindrical cells whose diameter is 5—8 μ. The uppermost cells in these filaments are almost entirely filled with protoplasm; whatever the reason may be the whole contents are often evacuated from the cells and found mostly as a spherical but sometimes also more irregularly shaped body at the end of the filaments (Fig. 83 *c*). Something quite similar often takes place also in the cells at the summit of the assimilating filaments; here also now and then the whole contents of the cells are emptied through a hole in the top of the cell; remnants of a membrane originating from such emptied cells are often found in the end of the assimilating filaments (Fig. 83 *e*). Here also short hairs are often found (Fig. 83 *f*, *g*), reminding one of those which Rosenvinge has found in *Nemalion*. They are entirely filled with protoplasm; when they die remnants of the walls remain at the end of the cell.

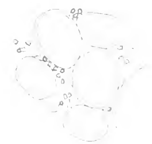

Fig. 84. *Liagora megagyna* nov. spec. Transverse section of medullary layer. (About 60 : 1).

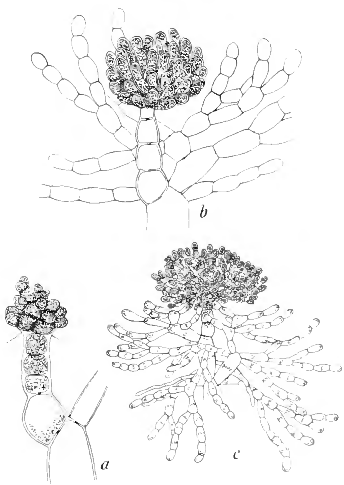

Fig. 85. *Liagora megagyna* nov. spec. Development of the cystocarp (comp. the text). (*a*, *b* about 160 : 1, *c* about 60 : 1).

The central filaments consist of long subcylindrical barrelshaped cells, whose diameter reaches a length of 100—160 μ or even more (comp. fig. 83 *a*, *b*). Along and between these thicker filaments smaller ones run irregularly in the mucilage; they originate from the basal cell in the peripheral filaments and consist of long cylindric cells about 150 μ long and 11 μ broad. Fig. 84 shows a transverse section of the medullary layer.

In about the middle of the assimilating filaments vigorous carpogonial branches are found (Fig. 83 *a*, *b*, *c*); these are nearly straight and placed laterally near the upper end of the almost cylindrical cells found here. Besides the carpogonial cell with its long trichogyne, it consists of three or four, rarely five cells. These have rather thick walls, are mostly shorter than long and a little swollen in the middle; their diameter reaches a length of about 20—27 μ, The shape of the carpogonial cell is short conical; it has rather thick peripheral walls. The full grown trichogyne is nearly cylindrical, often somewhat irregularly bent towards the summit, and a little thicker here; when young it is seen as a short obovate outgrowth from the carpogonial cell, later, on gradually growing longer, it assumes a clavate appearance and becomes at last nearly cylindrical.

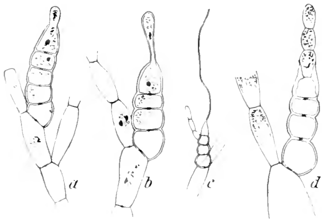

Fig. 86. *Liagora megagyna* nov. spec. *a*, *b*, development of the trichogyne. *c*, *d*, carpogonial branches producing vegetative filaments. (*a*, *b*, *d*, about 160 : 1, *c*, 60 : 1).

Having only found a very few fertilized carpogonia showing later stages I have not been able to follow the development in more detail. The youngest stage found is shown in fig. 85 *a*; we see here the outgrowth of the sporogenous filaments. Fig. 85 *b* shows a more advanced phase and in fig. 85 *c* is portrayed a nearly ripe cystocarpium. As is the case in other species so here the fertilization of the carpogonium exerts an influence upon the cell from which the carpogonial branch is issued and also upon some of the neighbouring cells; from these numerous filaments grow out more or less surrounding the basal part of the cystocarp.

Vegetative filaments were found several times in this species growing out from not fertilized carpogonial branches. Such outgrowths were either lateral from the cell below the carpogonium (Fig. 86 *c*) or terminal from the carpogonium itself (Fig. 86 *d*).

In this species I have not succeeded in finding antheridia.

This plant has only been found once in shallow water at Long Point at the south coast of St. Croix.

6. Liagora pulverulenta C. Ag.

Agardh, C., Species Algarum, 1821—2, p. 396. Agardh, J., Epicrisis, 1876, p. 516; Analecta Algologica, Continuatio III, 1896, p. 101.

The specimens I have referred to this species have a more or less regular dichotomous ramification but at the same time a good many proliferations are present (Fig. 87).

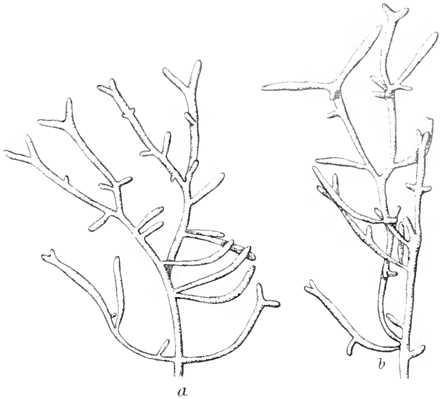

Fig. 87. *Liagora pulverulenta* C. Ag. Parts of two specimens from Rust up Twist. (About 3 : 1).

The assimilating filaments (Fig. 88 *a*, *b*, *c*) are relatively short, about 300 μ long; they are 5—6 times forked and their outline is corymbiform. In the lower part of the filaments the cells are subcylindrical, about 9—12 μ thick; higher up they become very thin their diameter varying from 3—6 μ; towards the summits of the filaments they rather suddenly grow shorter and at the same time thicker, oval or in the uppermost part nearly spherical, their diameter reaching a length of up to 12 μ. The cells in the summits of the young assimilating filaments often have long thin hyaline hairs whose length sometimes reaches double that of the assimilating filaments. When young these hairs are clavate with much protoplasm especially in the thickened end (Fig. 88 *d*, *e*, *f*); later they become

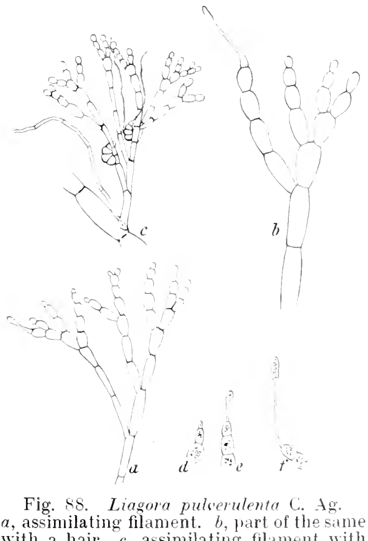

Fig. 88. *Liagora pulverulenta* C. Ag. *a*, assimilating filament. *b*, part of the same with a hair. *c*, assimilating filament with carpogonial branches. *d*, *e*, *f*, young hairs. (*a*, about 140 : 1; *b*, 200 : 1; *c*, 60 : 1; *d*, *e*, *f*, 160 : 1).

Fig. 89. *Liagora pulverulenta* C. Ag. Transverse section of medullary tissue. (About 60 : 1).

elongated and cylindrical with very little parietal protoplasm.

From the lowermost cells in the assimilating filaments some thin filaments arise (Fig. 88 *c*) running along and between the central filaments; they are branched and consist of rather long nearly cylindrical cells whose diameter is about 11 μ. From these erect filaments with oval cells occasionally grow upwards between the assimilating filaments (comp. Fig. 92 *a*).

The filaments of the medullary tissue are subcylindric-barrel-shaped; their diameter reaches a length of about 100 μ or more; in the mucilage between these large filaments run many thin ones; Fig. 89 shows a transverse section of the medullary tissue in which the large cells and the thin filaments are seen, in their respective positions.

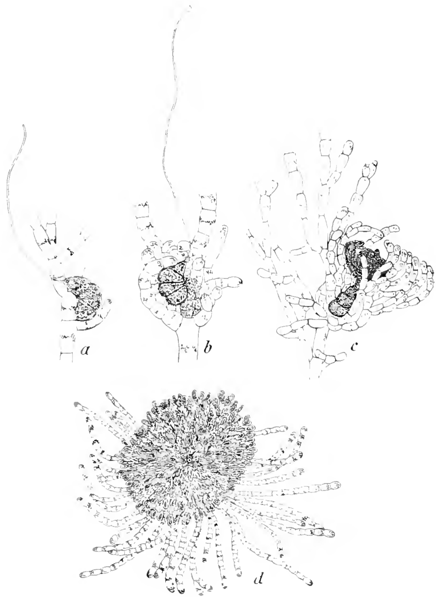

Fig. 90. *Liagora pulverulenta* C. Ag. Development of the cystocarp. (*a*, *b* about 160 : 1; *c*, 150 : 1; *d* 140 : 1).

The carpogonial branch is found nearly in the middle of the assimilating filaments (Fig. 88 *c*). It is placed laterally upon one of the nearly cylindrical cells found here. It consists of three cells and the carpogonium with the triohogyne. It is characterized by being much curved, the outline of the whole branch forming nearly a semicircle and its cells seen from the side having nearly a triangular shape; their diameter

reaches a length of about 12—14 μ. The carpogonium is conical and passes evenly into the long trichogyne.

After the fertilization (comp. Fig. 90) the sporogenous filaments grow out. These are repeatedly branched and form together a spherical rather compact body. In the summit of the filaments the carpospores are developed. Apparently even before fertilization, or in any case before any visible cell division has taken place in the carpogonium, filaments begin to grow out from the cell underneath that upon which the carpogonial branch is placed and these filaments are often considerably developed before the division of the carpogonium has begun (Fig. 90 *a*, *b*). In the more developed carpogonium they grow longer being several times forked and bent inward and they more or less surround the young cystocarp (Fig. 90 *c*); in the mature cystocarp on the other hand they are present like a whirl of prominent filaments at its base, and have the appearance of a collar thus giving the cystocarp a very characteristic aspect (Fig. 90 *d*).

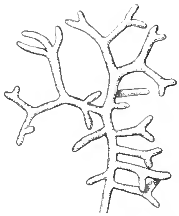

Fig. 91. *Liagora pulverulenta* C. Ag. Part of a plant. (About 3 : 1).

The antheridia are developed in the ends of the assimilating filaments as quite small oblong cells; they are 2—3 μ thick. In the material at hand they were only present in very small numbers. I have not found antheridia and cystocarps together in the same plant.

The above description is based upon material in spirit sent to me by Mr. O. Hansen Ganneskov and collectod at Rust up Twist on the north side of St. Croix.

Other specimens which I also refer to this species show a few differences. They were gathered in Lime Tree Bay on the south side of the same island where I found them growing epiphytic upon *Udotea flabellata* in shallow water.

Fig. 91 shows that the plant was a little more robust than the first described and the proliferations more regularly forked. The assimilating filaments (Fig. 92 *b*, *c*) had nearly the same size and shape, but the uppermost cells in the filaments were more spherical often nearly globular. The few carpogonial branches (Fig. 92 *d*) found were curved in the same way, but they contained only two cells besides the carpogonium which was very long. Neither more developed carpogonia nor cystocarps were present in the plant.

Some few other dried specimens I have also with some doubt referred to this species; but having had only dried and scanty material I shall not enter upon a description of them. In this connection I also want to point out that it is possible that some of these belong to *L. leprosa* J. Ag. How far this species is anything else than a form of *L. pulverulenta* I am not able to

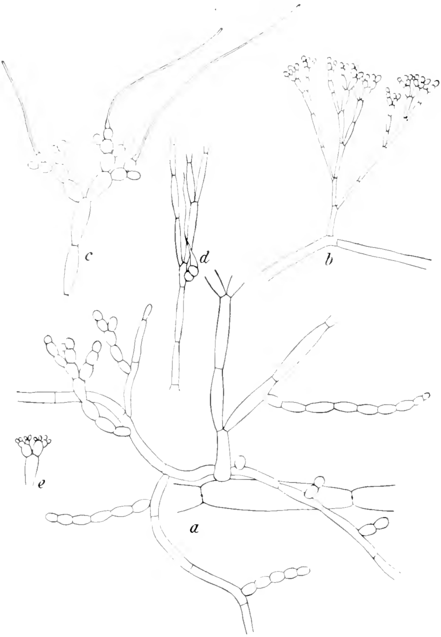

Fig. 92. *Liagora pulverulenta* C. Ag. From Lime Tree Bay. *a*, basal part of assimilating filament (comp. the text, p. 82). *b*, assimilating filament. *c*, assimilating filaments ended with long hairs. *d*, part of assimilating filament with carpogonial branch. *e*, antheridia. (*a*, *c*, *d*, about 140 : 1; *b*, 60 : 1; *e*, 170 : 1.)

decide. I am strongly inclined to think that the anatomical differences between the two species mentioned by J. AGARDH, are merely accidental. During a visit to Lund I had opportunity to examine the specimens in J. AGARDH's Herbarium and have not been able to confirm his observations. In a paper: "Notes on the species of *Liagora* and *Galaxaura* of central Pacific" BUTTERS has

given descriptions of the two species in question but I do not think he has found any more exact characters by means of which the two species could be separated. The form of the carpogonial branches he does not mention and a figure of the cystocarps would have been very desirable.

This species occurs both in sheltered and in more exposed places. It has been found as an epiphyte upon *Udotea flabellata* but it is attached mostly to stones, shells etc. It occurs in shallow water mostly; once I have taken it in a depth of about 20 meters.

It has been found at St. Croix: Lime Tree Bay, Rust up Twist; St. Jan: off Cruz Bay.

Geogr. Distrib.: West Indies, Gulf of Mexico.

Fam. 2. Chætangiaceæ.

Subfam. 1. Scinaieæ.

Scinaia Bivona.

1. Scinaia complanata (F. S. Collins) Cotton.

Cotton, A. D., New or little-known marine Algæ from the East (Kew Bulletin, 1907, p. 260) ex parte. Setchell, W. A., The *Scinaia* Assemblage (University of California Publications, vol. 6, no. 5, 1914, p. 100).

Scinaia furcellata var. *complanata* Collins, in Phyc. Bor. Am., Fasc. 17, no. 836, 1901; Rhodora, vol. 8, p. 110, 1906.

Scinaia furcellata Harvey, Nereis Bor. Am., part 2, p. 136 (ex parte).

var. *intermedia* n. var.

A var. typica præcipue differt fronde angustiore cylindrica, axi centrali conspicua.

In several respects the specimens found show very essential differences from Setchell's description, l. c., that I have no hesitation in considering them as representing a new variety.

The specimens (Fig. 93) reach a length of 8 cm. They all have a narrow frond the diameter of which reaches about 1—2 mm only, resembling as to this character the narrow specimens mentioned by Setchell.

As to the question whether these narrow specimens are flattened or not Setchell was not successful in solving the question with certainty only having dried material at his disposal. He writes: "While it is difficult to be absolutely certain whether the narrow forms are flattened or not, they seem to be so." I have

several specimens preserved in alcohol; when these are put in water they soon become turgescent and seem to assume quite the habit of the living plant. These specimens have shown themselves quite terete (Fig. 93). As far as I remember the living specimens were also terete.

Normally the thallus is not constricted but in the lowermost older part of the plant narrowings are found rather often. These are, however, scarcely quite normal, it seems rather as if they originated from some kind of damage, parts of the thallus having been cut off and young thin filaments having grown up from the older and broader ones and in this way giving rise to the constrictions.

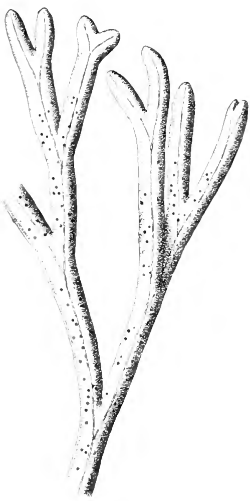

Fig. 93. *Scinaia complanata* (Collins) Cotton, var. *intermedia* nov. var. Part of a plant with cystocarps. (About 2:1).

As to the axial strand this was quite distinct through the whole thallus in the specimens preserved in spirit (Fig. 93), with the exception of the lowermost part quite near the base where the tissue of the plant is more compact and less translucent; in the dried specimens on the other hand it was not visible. It consists of about 20—30 broader filaments with proportionally tkick walls.

The shape of the epidermal cells (compare Fig. 94) seems to agree exactly with the description of SETCHELL: they are flattened or a little convex at the upper (outer) end, closely packed, 3—6gonal in surface view, in section quadratic to flattened rectangular, about 22—38 μ broad and 24—30 μ high.

Below the epidermal cells the cells with chromatophores form together a very loose cell-layer most of the cells being quite free with large open intervals between them. To judge from SETCHELL's description and figures the cells in my plant seem to be more elongated pyriform than those in his plant (compare Fig. 94 *a*).

The shape and the arrangement of the cystocarps appears to be in good accordance with the description of SETCHELL; the cystocarps occur scattered over the whole surface of the frond (Fig. 93) and are globular to pyriform in shape, narrowed abruptly

outwards, about 200 μ long and 170 μ broad, but both larger and smaller ones occur.

In a young growing tip SETCHELL found the "*punctum vegetationis*" convex projecting. As to this SETCHELL remarks: "Whether this is normal or not, it is strikingly different from the depressed *punctum vegetationis* as observed in all other species of *Scinaia* examined." In my specimens this is not the case; the tips of the plants in a turgescent state certainly appear to be convex projecting but when somewhat magnified the growing region is clearly found to be sunk.

It can not be denied that these differences in my plants from the typical *Scinaia complanata* are very essential. Even if I left out of consideration the fact that in SETCHELL's plant the growing point is not sunk, which as pointed out by SETCHELL himself, is very probably not normal, the terete thallus in my plant is a very striking character. And the axial strand being distinct through the whole thallus is of course also important and to these characters may yet be added the narrow thallus.

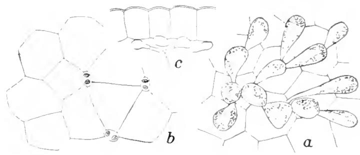

Fig. 94. *Scinaia complanata* (Collins) Cotton. var. *intermedia* nov. var. *a*, part of the epidermal cell-layer seen from the inner side showing the arrangement of the assimilating cells. *c*, transverse section of the same tissue. *b*, epidermal cells and antheridia seen from above. (*a* and *b* about 250 : 1, *c* about 150 : 1).

On account of these differences we apear to be entitled to consider these narrow forms as a variety to which I propose the name *intermedia*, this variety appearing to me to be a connecting link between *Scinaia complanata* and *Scinaia furcellata.*

In his newly published highly interesting paper on *Scinaia furcellata*, SVEDELIUS[1]) describes for the first time monospores as occurring in this species. As is well known tetraspores are never met with in *Scinaia* and the discovery of the monospores is therefore highly interesting. I have been looking carefully for these organs in my specimens but without success, only antheridia were present. Also I did not succeed in finding

[1]) SVEDELIUS, NILS, Zytologisch-entwicklungsgeschichtliche Studien über *Scinaia furcellata.* Ein Beitrag zur Frage der Reduktionsteilung der nicht tetrasporenbildenden Florideen. (Nova Acta Regiae Soc. Scient. Upsaliensis, Ser. IV, Vol. 4, No. 4. 1915).

hairs. The presence of hairs in *Scinaia furcellata* is mentioned by ROSENVINGE[1]). These are now described in detail by SVEDELIUS.

This plant has been found in deep water only, in dephts from 20—30 meters. The specimens were collected in the month of March and had antheridia and cystocarps.

It has been gathered in the sound between St. Thomas and St. Jan in several places off Cruz Bay, and off America Hill in the sea to the north of St. Jan.

Geogr. Distrib. Florida, Bermuda.

Subfam. 2. **Chætangieæ.**

Galaxaura Lamouroux.

In his very valuable monographical work, "Om Floridé-slägtet Galaxaura, dess organografi och systematik" (Kongl. Svenska Vetensk.-Akad. Handl., Bd. 33, No. 1, Stockhlom 1900) KJELLMAN has shown that most of the older species are collective-species, in reality comprising often several easily distinguishable species.

As a result of his examination KJELLMAN describes a great number of new species, he mentions in all 62, many of which seem to be very nearly related. As regards these species, however, in all cases with which I am personally acquainted they seem to be well founded.

These many species are relegated by KJELLMAN to nine principal groups, based essentially upon the different development of the assimilating tissue.

KJELLMAN based his work exclusively upon material which was found in his own berbarium, and in Herb. ARESCHOUG in Stockholm supplemented with specimens from J. AGARDH in Lund. Without doubt this material has proved to be very rich as is evident from the numerous species it contained, but, nevertheless, KJELLMAN's work would have been yet more valuable had he also cleared up, as far as possible, the older species and identified them with the forms which were found in the collections examined by him. This ought especially to be done with the species of ELLIS and SOLANDER described in "The natural history of many curious and uncommon Zoophytes", London 1786, a most valuable work for that time.

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[1]) ROSENVINGE, L. KOLDERUP, Remarks on the hyaline unicellular hairs of the Florideae. (Biologiske Arbejder tilegnede EUG. WARMING paa hans 70 Aars Fødselsdag. København 1911, p. 204).

It seems, however, most probable that these old plants are no longer in existence. At my request Mr. A. D. Cotton has most kindly made a search in the Kew Herbarium without success and furthermore he writes to me that Mr. A. Gepp tells him that none of Ellis and Solander's types are in the British Museum and that he together with Mrs. Gepp had been to the Royal College of Surgeons, where the collection of Ellis and Solander was supposed to have been preserved and had made a personal search also without success. But of course this negative result is also of interest; had the species of Ellis and Solander existed an examination of these would certainly have resulted in several of the specific names of Kjellman being changed.

By the fact that Liebman and Ørsted have sent Areschoug material of many of the algæ which they have collected in the West Indies, Kjellman has had relatively rich material from this region and several of his species are based upon specimens from the Danish Islands. During the determination of my collection it has been of great help to me to have had on loan all the material of *Galaxaura* determined by Kjellman.

In the following survey 11 species are mentioned belonging to the following 5 of Kjellman's 9 groups, namely:

Sectio I. *Rhodura* Kjellm.

A. with long assimilating filaments . . . . 1. *G. comans* Kjellm.
B. with long and short assimilating filaments.
  I. assimilating filaments often clearly arranged in belts
  2. *G. subverticillata* Kjellm.
  II. assimilating filaments evenly distributed over the whole surface.
    a. thallus with long internodes, flagellate . . . .
    3. *G. flagelliformis* Kjellm.
    b. thallus with shorter internodes
      1. large, much ramified tufts, thallus flexible, densely covered with long hairs . 4. *G. lapidescens* (Sol.) Lamx.
      2. low tufts, thallus fragile, rugose. 5. *G. delabida* Kjellm.

Sectio II. *Microthoë* Desne, J. Ag.

a. thallus quite or nearly glabrous, annularly constricted internodes of nearly the same length . . . .
6. *G. rugosa* (Solander) Lamx.
b. the assimilating filaments more persistent, less annularly constricted internodes of variable length. 7. *G. squalida* Kjellm.

Sectio III. *Eugalaxaura* (Desne) Kjellm.

a. With broader, proportionally shorter and somewhat rugose internodes. . . . . 8. *G. fragilis* Lamk.

b. With long, nearly cylindric internodes . . . . 9. *G. cylindrica* Solander.

Sectio IV. *Brachycladia* Sonder.

10. *G. marginata* (Sol.) Lamx.

Sectio V. *Vepreculæ* Kjellm.

11. *G. occidentalis* n. sp.

Sectio I. *Rhodura* Kjellm.

1. Galaxaura comans Kjellm.

KJELLMAN, F. R., Floridé-slägtet Galaxaura, p. 44.

This species KJELLMAN based upon a small, rather tiny but otherwise well developed specimen collected at Guadeloupe and sent to ARESCHOUG from CROUAN.

The specimen (Fig. 95) I have gathered is large and vigorous, much larger than the original one, reaching a height of about 12 cm.

It is irregularly ramified with long internodes of very variable length up to 3 cm or even more. The branches are very rigid and protuberant; their diameter, including the hairs, reaches 3—5 mm being narrowed towards the apex. The whole thallus is densely covered with rigid prominent hairs and is of a dark red colour.

A transverse section shows that the medullary tissue consists of proportionately thick filaments commonly about 20 μ thick, but both thinner and thicker ones are present. The peripheral cells which bear the assimilating hairs are mostly almost isodiametric often quadrangular about 50 μ broad (Fig. 96 *a*); each cell commonly bearing a single assimilating filament, seldom two (Fig. 96 *a*). The assimilating filaments consist at their base of a large oval cell about 80 μ long and 50 μ broad; then follow two or three still oval cells decreasing gradually in size. The rest of the filaments consists of cylindrical cells about 19 μ broad; the length of the cells is rather variable, some are up 40 μ long or more, others especially in the upper end are shorter, not much longer than they are broad. The whole filament reaches a length of up to 1—2 mm.

Kjellman found ramified filaments rather frequently in his specimen and these occurred also in mine (Fig. 96 *b*).

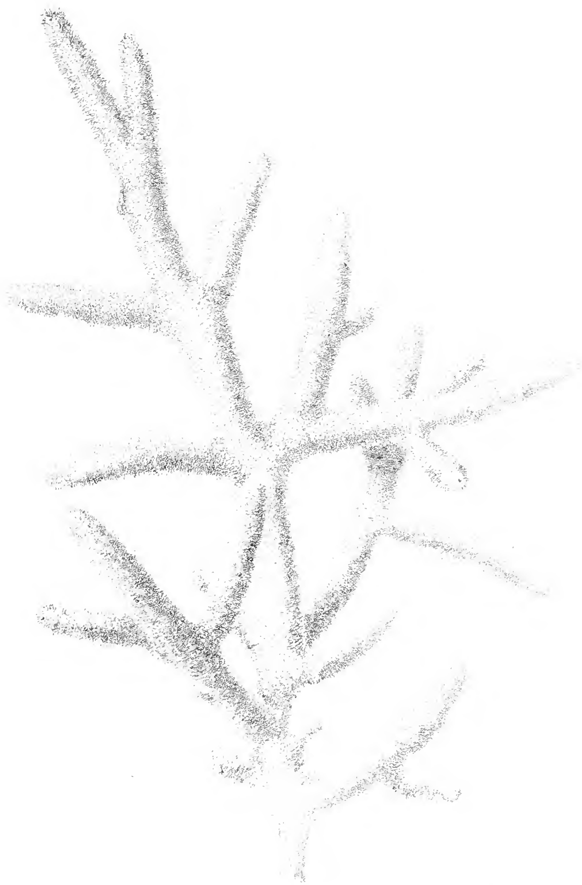

Fig. 95. *Galaxaura comans* Kjellm. Part of a plant. (About 1,5 : 1).

This species has only been found once in a depth of 8 fathoms in the sea to the north of St. Jan: off America Hill.

Geogr. Distrib. West Indies.

2. **Galaxaura subverticillata** Kjellm.

Kjellman, F. R., Floridé-slägtet Galaxaura, p. 48.

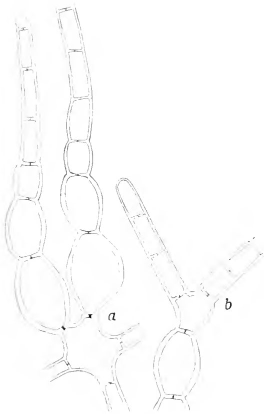

Fig. 96. *Galaxaura comans* Kjellm. *a*, basal parts of assimilating filaments with the supporting cell. *b*, base of a ramified filament. (About 150 : 1).

This species has been described from specimens which Ørsted collected at St. Croix and sent to Areschoug. In the Botanical Museum, Copenhagen, some more specimens of Ørsted's from St. Croix are to be found which quite agree with the specimens determined by Kjellman.

The specimens I have collected (compare Fig. 97) seem to agree very well with the original examples. In this species both long and short assimilating filaments are present and the most striking character is the verticillate arrangement of the filaments. This annular arrangement is most clearly present in the young parts of the thallus, in the older ones the long hairs occur in a more scattered manner over the whole surface and some specimens are even found in which the annular arrangement is much reduced, the specimens having an almost even but rather open covering of hairs over the whole surface. Kjellman explains this fact by considering that the short hairs later on grow out more or less into long ones.

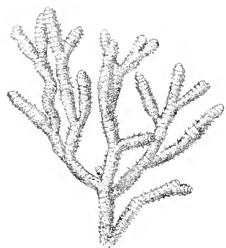

Fig. 97. *Galaxaura subverticillata* Kjellm. Part of the thallus. (About 1,5 : 1).

The surface of the thallus, especially in that of the upper young ends, is rugose and often clearly annulated.

The internodes are nearly cylindrical, mostly constricted at the base, of variable length but usually short seldom exceeding 1 cm.

The colour of my specimens was greyish olive-green with a reddish tinge especially in the younger parts of the thallus.

A transverse section shows the medullary tissue to consist of the usual, rather thick walled, cylindric cells woven together. The

diameter of the central tissue being about 600 μ. The cells which bear the assimilating filaments are well developed, quadrangular (sometimes triangular), about 45 μ broad.

The short assimilating filaments usually consist of three sometimes of two cells only. The basal cell is large, oval, about 65 μ long and 45 μ broad. The diameter of the uppermost small cells varies between 16 and 25 μ. The sizes KJELLMAN gives for these cells are somewhat greater but in the specimen of the original material which I have examined I found the size of these cells agreeing very well with that of mine. In the long assimilating filaments the basal cells are of a similar size to those of the short filaments, the filament itself is about 16 μ thick and consists of cylindric thick-walled cells about 30 μ long.

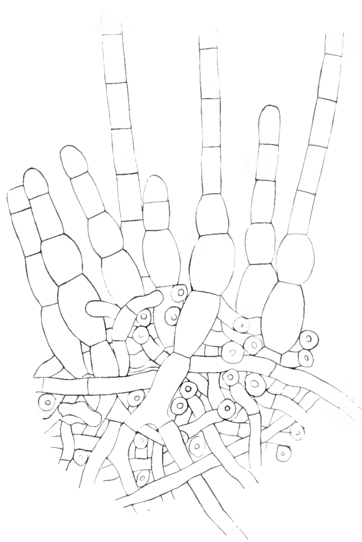

Fig. 98. *Galaxaura flagelliformis* Kjellm. Tranverse section of a young thallus with mostly long assimilating filaments in different stages of development. (About 150:1).

This species was found growing in shallow water and in an exposed locality at Long Reaf near Christiansted, St. Croix. Furthermore a specimen washed ashore at Sandy Point, St. Croix, has been sent to me by Dr. HAMBURGER. ORSTED does not indicate the locality where he found his specimens.

Mlle. VICKERS mentions this species from Barbados in her list and I have specimens of it from Jamaica (Kingston) where it was found by Mr. O. HANSEN GANNESKOV.

Geogr. Distrib. West Indies.

3. Galaxaura flagelliformis Kjellm.

KJELLMAN, F. R., Om Floridé-slägtet Galaxaura, p. 47.

This species was based by KJELLMAN upon specimens from Key West, Florida, collected by BAILEY and preserved in Herb. ARESCHOUG in Stockholm.

My specimens seem to agree quite well with those of KJELLMAN.

In a transverse section of the thallus (Fig. 98) it is seen that the medullary layer consists of rather thin filaments woven between each other; they are of variable breath, their diameter being 12—16 μ thick or even more. The supporting cells at the periphery are mostly not much developed; they are irregularly 3—4-gonal (Figs. 99 and 100), up to 40 μ in diameter. They carry each a single or more rarely two assimilating filaments, short or long. The short ones (Fig. 99 *b*, Fig. 100) mostly consist of three cells, someones only of two; the basal cells are large, oval, about 60—70 μ long and 40 μ broad, the others smaller, the uppermost have only a diameter about 27 μ long. The basal cells in the long assimilating filaments (Fig. 99 *a*) have nearly the same size and shape. The breadth of the cells in the cylindrical part of the filaments seem to vary somewhat, in one specimen I found the diameter to be about 16 μ, in another even 18 μ; KJELLMAN states the diameter to be 15 μ. The length of the cells is often more than double the breadth.

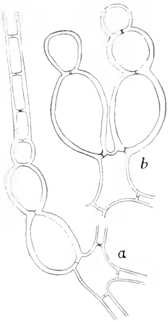

Fig. 99. *Galaxaura flagelliformis*. *a*, basal part of long assimilating hair. *b*, short assimilating filaments, one with two cells, another with three. (About 150 : 1).

Regarding the habit of the plant the accompanying figure (Fig. 101) gives an idea. The plant is, as pointed out by KJELLMAN, large, about 16 cm high not much ramified with very long internodes and the branches spreading much and often somewhat recurved at the summits. It is evenly covered with hairs over the whole surface and of a reddish brown colour.

This species has been found in deep water only down to a depth of about 20—30 meters.

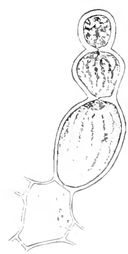

Fig. 100. *Galaxaura flagelliformis* Kjellm. Short assimilating filament with chromatophore and pyrenoid in the upper end of the cell. (About 175 : 1).

St. Jan: Off Hermitage and in several places in the sound between this island and St. Thomas.

Geogr. Distrib. Florida, West Indies.

4. Galaxaura lapidescens (Sol.) Lamx.

LAMOUROUX, J. V. F., Histoire des Polypiers corall. flexibl. 1816, p. 264. KJELLMAN, F. R., Floridé-Slägtet Galaxaura, p. 39—43.
Corallina lapidescens Solander in ELLIS and SOLANDER, Natural History

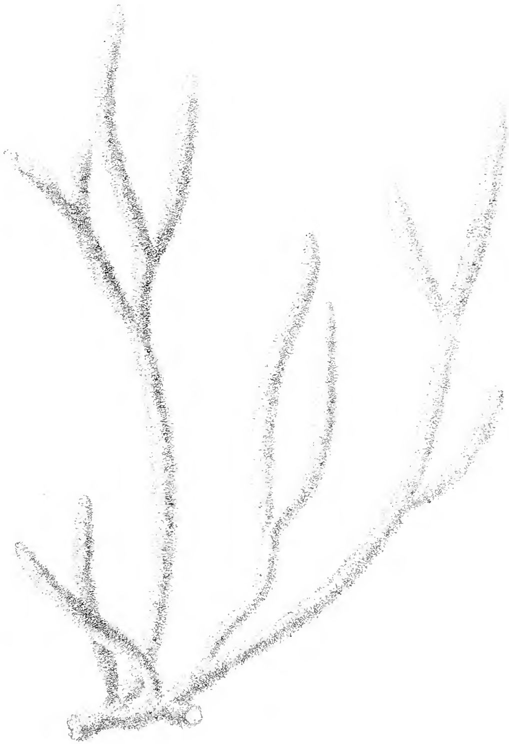

Fig. 101. *Galaxaura flagelliformis* Kjellm. Part of a plant. (About 1,5 : 1).

of many curious and uncommon Zoophytes, London 1786, (ex p., comp. the text below).

As pointed out by KJELLMAN so many different forms occurring in nearly all tropical seas have in the past been referred to *Galaxaura lapidescens*, originally described by SOLANDER, that it was to be supposed, a priori, that this species comprehended in

reality several distinct species, all densely haired forms having been referred to it.

Referring to the comprehensive survey of KJELLMAN, quoted above, for further details of this question I only wish to point out here that SOLANDER already mentions two varieties of his *Corallina lapidescens.* He says (l. c., p. 113): "There are two varieties of this Coralline, one that is always dichotomous, Tab. 22, fig. 9, and another that sends out three or more joints from the same place, Tab. 21, fig. g," and his description of some specimens "preserved in spirits as they were taken out of the sea" in which the "fine short reddish hairs come out in regular whirls or circles", seems to suggest that he has had to do with a third species e. g. *G. subverticillata* or a similar one. While SOLANDER nearly always mentions the localities from whence the plants originate, he unfortunately does not give any localities for this species.

As is clear from this the founder of the species referred perhaps even three different forms to it and afterwards nearly all long-haired forms have, as pointed out above, been considered as belonging to it. The only investigator who has tried to divide this species is KÜTZING who in "Tabulæ Phycolgicæ", vol. VIII, p. 38 has two species namely: *G. lapidescens* and *G. tomentosa.* But J. AGARDH in Epicrisis, p. 530, refers KÜTZING's species *tomentosa* to *G. lapidescens* as a variety only That J. AGARDH nevertheless had some doubt how far *G. lapidescens* should be separated is evident, as was also pointed out by KJELLMAN, not only from his remark in Epicrisis, l. c.: "an plures species hoc loco lateant", but also from what is said in "Till Algernes Systematik", 4de afdeling, VII Florideæ, p. 75. Yet I shall only mention that ASKENASY in "Forschungsreise S. M. S. Gazelle", IV Teil, p. 33 with regard to the occurrence of *G. lapidescens* says that it is common in all tropical seas. Thus matters stood when KJELLMAN commenced his thorough investigations.

As a result of these studies this species is now divided into a great number of species with more restricted distribution. But as KJELLMAN had no opportunity to examine the original specimens of ELLIS and SOLANDER he did not know with certainty which of his species ought in future to be named *lapidescens* and among the species which he refers to the group *Rhodura* he does not mention it. On the other hand in the introductory remarks to the *Rhodura* group he points out that in his opinion this species ought to be maintained and he

adds that he thinks that the plant which KÜTZING in Tabulæ Phycologicæ, vol. 8, pl. 38, fig. I has figured as *G. lapidescens* might correctly be considered as this species. However, it seems to me, the figure (pl. 21, fig. *g*) of ELLIS and SOLANDER gives a very good idea of the plant and I think it is more correct to take this the first published figure of the plant, as the type of the species. In spite of this I do not mean that the figure of KÜTZING in question would not also represent a form of this species[1]). An examination of the original material of ELLIS and SOLANDER would of course be the most conclusive but as mentioned in my introductory remarks to this genus the type specimens do not now seem to exist.

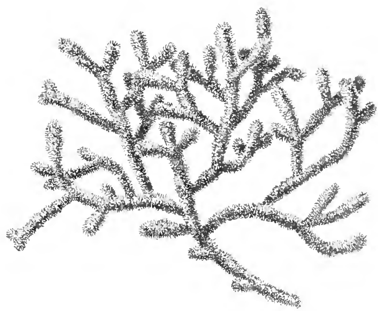

Fig. 102. *Galaxaura lapidescens* (Sol.) Lamx. Part of a plant. (About $1^1/_2 : 1$).

All the specimens I have found are much ramified, forming large dense tufts (Fig. 102). These are fastened to the substratum by means of a broad disc from which several branches often arise. These branches are repeatedly subdichotomously ramified. The internodes are cylindric of variable length, sometimes they are more than 1 cm long sometimes shorter. In the middle of the thallus the diameter of the branches without hairs reach a length of about

[1]) As on account of this fact it seemed to be of great importance to examine the two plants upon which KÜTZING based his drawings of *Galaxaura lapidescens* and *Galaxaura tomentosa* I asked Mme WEBER to allow me to investigate a little bit of the two plants in question which as said by KÜTZING both originate from Mexico. At my request she greatly obliged me by sending a small piece, enough for microscopical examination, of *Galaxaura tomentosa* originating from Mexico, but she told me at the same time that in the Herb. KÜTZING belonging to her there was no specimen of *Galaxaura lapidescens* from Mexico. Having examined the piece of *Galaxaura tomentosa* I arrived at the conclusion that this plant of KÜTZING is like *Galaxaura Liebmanni* (Aresch.) Kjellm., described as *Holonema Liebmanni* 4 years earlier by ARESCHOUG in "Phyceæ novæ", 1854, p. 356.

1 mm, with the hairs the diameter is more than 2 mm. The hairs are evenly distributed over the whole thallus giving it a felted appearance. The colour is rather variable, in some specimens red-brown in others greyish olive-green with a more or less reddish tinge.

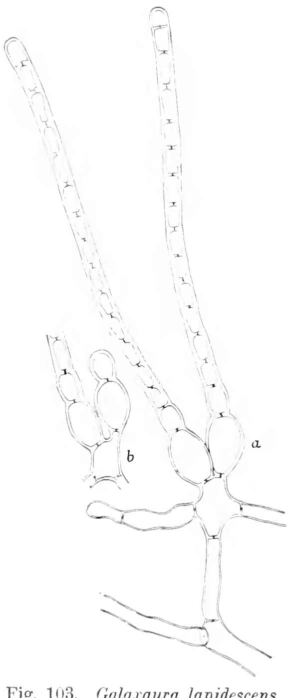

Fig. 103. *Galaxaura lapidescens* (Sol.) Lamx. *a*, long assimilating filaments, *b*, short assimilating filament and basal part of a long one issued from the same supporting cell. (About 150:1).

As to the anatomical structure the medullary tissue consists of rather thick-walled filaments woven together. The filaments are of very variable size most often about 11—13 μ broad but some occur which reach more than the double thickness; the diameter of the whole tissue reaches a width of about 650 μ.

Towards the periphery these filaments bare the polygonal supporting cells commonly found in this group (compare Fig. 103). These are mostly 4-gonal and about 40—50 μ broad. The assimilating filaments arising from these cells are of two different kinds, some short and others long. In the older parts of the thallus the long assimilating filaments especially occur while the shorter ones usually are very rare, in the young thallus the shorter assimilating filaments are quite as common as the longer ones. The short filaments consist of three, sometimes only of two cells (Fig. 103 *b*) and these cells decrease rapidly in size upwards. The lowest cells are large up to 70 μ or even longer and about 45 μ broad, the uppermost ones are only about 28—30 μ broad.

The basal cells in the long assimilating filaments are of about the same shape and size as those in the short filaments. Above the lowest largest one, a smaller oval cell follows and sometimes the following cell is yet somewhat swollen in the middle while the rest of the cells in the filament are cylindrical, mostly about

19 μ thick reaching a length of up to 2—3 times their own breadth.

All walls in the filaments are thick and stratified not only in the basal cells but also in the cylindrical upper ones (Fig. 104).

In the cells of the assimilating filaments a well-developed chromatophore is present (Fig. 104). It lies near the upper end of the cell, is campanulate with long prolongations down the wall of the cell and contains a large pyrenoid in its centre. In the cylindrical cells the pyrenoid lies nearer the middle of the cell.

Of the species described by KJELLMAN this plant seems to come near to *Galaxaura Liebmanni*. Besides the small type specimen in Herb. ARESCHOUG I have seen some larger ones also collected by LIEBMANN in Mexico and belonging to the Botanical Museum, Copenhagen. These show that the species has a more robust and thicker thallus, the filaments in the medullary tissue are thicker about 19 μ, there are often 2—3 large cells at the base of the long assimilating filaments and the basal cell of these are somewhat larger (about 75 μ long and 55 μ broad); also the cylindrical part of the long assimilating filaments is thicker, its diameter reaching 22 μ.

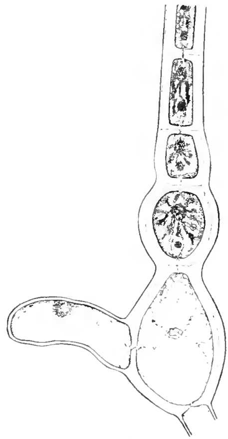

Fig 104. *Galaxaura lapidescens* (Sol.) Lamx. Basal part of an assimilating filament with chromatophores and pyrenoids; below in the cells the nuclei are made visible by staining. (About 400 : 1).

Also *G. ramulosa* seems to show some likeness to this species, but it differs among other things by the vigogorous short assimilating filaments the uppermost cells of which are relatively large, and by the thinner, long assimilating filaments.

G. lapidescens was found mostly in sheltered places and in shallow water, e. g. in lagoons and bays, once it was taken in the open sea at a depth of about 12 meters.

St. Croix: The harbour of Christianssted, off Frederikssted, Lime Tree Bay. St. Thomas: Bovoni Lagoon.

Geogr. Distrib.: West Indies.

5. Galaxaura delabida Kjellm.

KJELLMAN, F. R., Om Floridé-slägtet Galaxaura, p. 49.

Of this plant I have only seen the original material which is now kept in Herb. KJELLMAN in the Botanical Museum in Upsala; it was collected at St. Thomas and distributed by P. T. CLEVE.

The original material consists of numerous mostly small pieces.

KJELLMAN points out that the most characteristic feature of this species is that the filaments in the medullary tissue differ very much in thickness, and that the supporting cells are often not developed, the assimilating filaments in this case growing directly out from the medullary filaments. The short assimilating filaments often consist of two cells only. The long assimilating filaments are about 15 μ broad and have comparatively short cells, $1^1/_2$—2 times as long as broad.

KJELLMAN supposes that the plant forms low tufts pressed to the substratum.

Geogr. Distrib.: At present only known from St. Thomas.

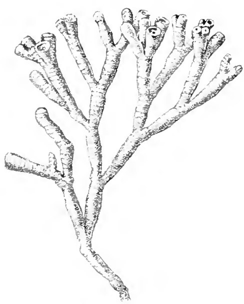

Fig. 105. *Galaxaura rugosa* (Solander) Lamx. Part of a plant. (About $1^1/_2$: 1).

Sectio II. *Microthoë* Dcsne, J. Ag.

6. Galaxaura rugosa (Solander) Lamx.

LAMOUROUX, J. V., Histoire des Polypiers coralligènes flexibles, Caen 1816, p. 263. KÜTZING, Fr., Tabulæ Phycologicæ, vol. VIII, tab. 33, fig. 1. AGARDH, J. G., Epicrisis, p. 528. KJELLMANN, F. R., Floridé-slägtet Galaxaura, p. 55.

Corallina rugosa Solander in ELLIS, J., and D. SOLANDER, The Natural History of many curious and uncommon Zoophytes, London 1786, p. 115, tab. 22, fig. 3.

KJELLMAN does not give any description or figures of this old species of SOLANDER but refers to the description of J. AGARDH in Epicrisis and to the figures of ELLIS and SOLANDER, p. 115, tab. 22, fig. 3, and of KÜTZING in Tabulæ Phycologicæ, vol. VIII, tab. 33, fig. 1. But on the other hand, when describing several new species related to or formerly considered as forms of *G. rugosa*, he points out in what way they differ from this species.

The specimens which I refer to *G. rugosa* (Fig. 105) are certainly very like those I refer to the following species, on the other

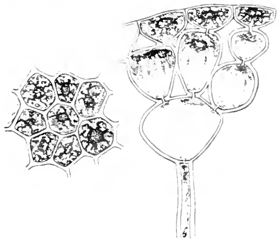

Fig. 106. *Galaxaura rugosa* (Solander) Lamx. Transverse section of the thallus and surface cells seen from above. In the cells the campanulate—stellate chromatophores with the pyrenoid in the middle. (About 250 : 1).

hand they show just the differences KJELLMAN has noted.

The most essential and striking difference is the smaller development of the assimilating filaments. The well developed annular groups of hairs found in *G. squalida* in the younger parts of the thallus were not present in these specimens; only in the older part of the thallus hairs occasionally occurred. The diameter of these hairs was about 16—18 μ.

The ramification is perhaps somewhat more regularly dichotomous in this species, the internodes being nearly of the same length, but variations occur. Owing to the lesser development of the hairs the surface of the plant is almost quite smooth. The annulations are well developed. In the dried specimens the green colour was more prominent and the red tinge originating from the hairs in *G. squalida* was lacking.

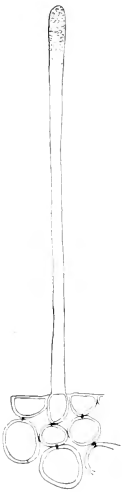

Fig. 107. *Galaxaura rugosa* (Solander) Lamx. Surface cell with long unicellular hair. (About 175 : 1).

As to the anatomical structure I have not found any differences worth mentioning. The fig. 106 shows a transverse section of the peripheral tissue; this consists of 3—4 layers of cells the innermost largest; large lobed cells were common, quite in accordance with that which is found in *G. squalida*.

In a collection from Lime Tree Bay at St. Croix hyaline unicellular hairs were found abundantly in the young tips of the plant (Fig. 107). These hairs grow out from the peripheral cells. They are long, nearly cylindric, when full grown about 200—300 μ long and 6—8 μ thick. The upper end is filled with protoplasm. Their development seems to agree perfectly with the description of ROSENVINGE as to similar hairs in other Florideæ[1]).

[1]) ROSENVINGE, L. KOLDERUP, Remarks on the hyaline unicellular hairs of the Florideæ in Biologiske Arbejder tilegnede EUG. WARMING, København, 1911, p. 207.

This species grows in shallow water and in somewhat sheltered places.

It seems to be common. It has been collected in the following places. St. Croix: Coakley Bay, Christianssteds Harbour, Rust up Twist, Cane Garden, Sandy Point, Lime Tree Bay. Some old specimens from St. Thomas, collected by RAVN, are found in the collections of the Botanical Museum, Copenhagen.

Geogr. Distrib.: West Indies.

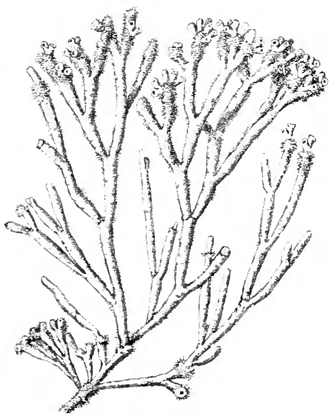

Fig. 108. *Galaxaura squalida* Kjellm. Part of the thallus showing the groups of hairs occurring now and then especially in the young parts of the thallus. (About 1,5 : 1).

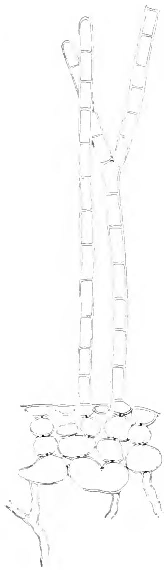

Fig. 109. *Galaxaura squalida* Kjellm. Transverse section of the thallus with lobed cells and assimilating filaments, one of which is ramified. (About 150 : 1).

7. **Galaxaura squalida** Kjellm.

KJELLMAN, F. R., Om Floridé-slägtet Galaxaura, p. 55.

This species has been described from specimens collected at St. Croix by ORSTED and preserved in Herb. ARESCHOUG in Stockholm. In the herbarium of the Botanical Museum, Copenhagen, I have found several of ORSTED's specimens belonging to this species. The description below is especially based upon my own material.

The plant (Fig. 108) forms dense richly ramified tufts which are fixed to the substratum by means of a broad disc composed

of numerous irregularly bent filaments felted together; these filaments have fairly thick walls and a breadth of about 16 μ while their length is often up to ten times the breadth.

From this base several branches grow up and these are repeatedly dichotomously ramified. The internodes are of very variable length from one to two cms. The branches are cylindrical, also in the dried condition, with the exception of the quite young upper ends, not yet much incrusted which collapse being more or less flat when dry. In the spirit material the apices are nearly cup-shaped with the sunken growing point in the middle.

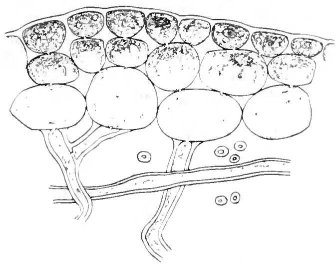

Fig. 110. *Galaxaura squalida* Kjellm. Transverse section of the thallus showing the periferic tissue with chromatophores and pyrenoids. (About 250:1).

The colour of the dried plant is a sordid yellow-green with a red-brown tinge especially where the assimilating hairs are present. These do not occur evenly distributed over the whole surface; they are most numerously present upon the younger parts of the branches and often show here an annular arrangement but quite scattered ones also often occur especially upon older parts of the thallus.

The surface of the plant is mostly rather clearly annulated.

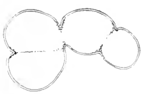

Fig. 111. *Galaxaura squalida* Kjellm. A lobed cell from the periferic tissue. (About 200:1).

A transverse section shows that the medullary tissue is composed of rather thick-walled dichotomously branched filaments consisting of long cylindrical cells of which the diameter varies from 7 to 16 μ. The periferal tissue consists of short often dichotomously ramified cell-threads composed of 3—4 cells (Figs. 109, 110). Of these the innermost are the largest; they are mostly roundish but very large ones, irregularly shaped and lobed are often found (Figs. 109, 111). These lobed cells are also mentioned and figured by KJELLMAN and occur in several other species. This cell layer is about 40 μ thick, but the cells are very variable in size the large lobed cells being often much thicker. These cells are colourless and contain only protoplasm, cell sap etc.

The next cells are smaller (about 25—30 μ in diameter), nearly

spherical and have rather well developed chromatophores. Finally we arrive at the epidermal cells, the real assimilating ones. These are short, 10—12 μ long and 20—24 μ broad, in transverse section often triangular, when seen from above 5—7-gonal and closely united (comp. those found in *G. squalida*, Fig. 106). They contain a well developed campanulate chromatophore with long branched prolongations running down along the walls of the cells (Fig. 110); in the middle of the chromatophore a pyrenoid is present. But besides this, the real assimilating tissue, the plant possesses the above mentioned assimilating filaments (Fig. 109); these are composed of a row of cells which are abuot 2—3 times as long as broad (lat. about 15—18 μ) and have thick walls, 4 μ thick. They contain a much ramified chromatophore.

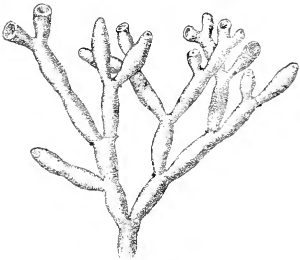

Fig. 112. *Galaxaura fragilis* Lamk. Part of the thallus. (About $1^1/_2$: 1).

The chalk incrustation is richly developed and found throughout the whole tissue.

A specimen from the harbour of Christianssted had apparently ripe cystocarps. These are nearly spherical with an opening above. The carpospores are large, oval, about 50 μ long and 30 μ broad.

My specimens seem to agree very well with the description of KJELLMAN and with the original specimens from St. Croix. As pointed out above with regard to *G. rugosa*, this species is nearly related to the present one; for the differences between them I refer to the comparative remarks given above.

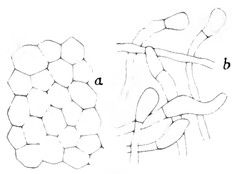

Fig. 113. *Galaxaura fragilis* Lamk. *a*, epidermal cells seen from above. *b*, filaments from the diaphragms. (About 250 : 1).

Galaxaura squalida has been gathered both in shallow water in more sheltered places and in deeper water at a depth of about 30 meters and in more open sea.

It was found in the following localities: St. Croix: Christianssteds Harbour, off Frederikssted. At the shores of this island it was also col-

lected by Ørsted. St. Jan.: Coral Bay, and in the sound between St. Thomas and St. Jan near the island St. James.

Geogr. Distrib.: West Indies.

Sectio III. *Eugalaxaura* (Dcsne) Kjellm.

8. Galaxaura fragilis (Lamk.) Kütz.

Kützing, Spec., p. 530. Kjellman, F. R., Floridé-slägtet Galaxaura, p. 60.
Dichotomaria fragilis Lamk. Lamarck, J., Histoire naturelle des animaux sans vertèbres, t. II, 1816, p. 145.

The specimens (Fig. 112) have a glabrous, when dry often shining surface. The annulation which in some of the specimens determined by Kjellman was very prominent was not so distinct in my plant. The branches are fairly regularly dichtomously forked. The internodes are 4—5 mm long, mostly slender at their base growing thicker upwards, more rarely nearly cylindrical; at their base an annular bursting of the calcareous layer is often present. The colour of the dried plant is light yellow green often also more reddish.

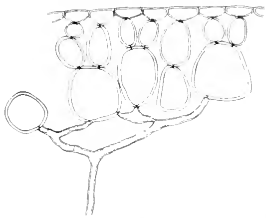

Fig. 114. *Galaxaura fragilis* (Lamk). Transverse section of the thallus. (About 250:1).

The whole plant is very fragile. A transverse section reveals the fact that the medullary tissue is very loose; it consists of dichotomously ramified, rather thick-walled filaments running between each other; their diameter is about 8 μ long. The diaphragms at the joints the presence of which especially characterizes the Sectio *Eugalaxaura* are formed in the following manner. Numerous filaments are crowded more firmly together and furthermore the ends of these filaments are much thickened, their diameter reaching often 17 μ or more (Fig. 113 *b*).

The peripheral tissue (Fig. 114) is about 70 μ thick. It consists of short, dichotomously branched filaments the cells of which form together a parenchymatous tissue; with the exception of the epidermal cells, all other cells in this tissue are easily separable after decalcification. The innermost cells are the largest; they are roundish in shape and their diameter reaches a length of about 35 μ. Towards the periphery the cells grow smaller, the epidermal cells being the smallest ones. These are fairly strongly united and when seen from above 5—6-gonal

(Fig. 113 *a*), about 14 μ broad, while their length in transverse section is seen to be about 8 μ only.

The chromatophore is found in the upper end of the cells; it has the common campanulate shape with a pyrenoid in the middle. It is most developed in the epidermal cells, but it is in the whole not especially large.

KJELLMAN points out that judging from ELLIS and SOLANDER's figure 4, plate 22, it is not impossible that the plant which here is called *Corallina cylindrica* is not the species we now call *cylindrica* but the present one. In considering this figure, it certainly can not be denied, that the length of the internodes are in proportion to their breadth too short, and that in this respect the figure agrees better with *G. fragilis.* But to state this with certainty an examination of the original specimen is necessary.

This species has been found in a depth of about 12 meters in more open sea.

Only found once at St. Croix: off Frederikssted.

Geogr. Distrib.: West Indies, Atlantic coast of South America.

9. **Galaxaura cylindrica** (Solander) Kjellm.

KJELLMAN, F. R., Om Floridé-slägtet Galaxaura, p. 64.

Corallina cylindrica in ELLIS, J., and D. SOLANDER, The Natural History of many curious and uncommon Zoophytes, 1786, p. 114.

I have not collected this plant myself but in the Botanical Museum, Copenhagen, several large specimens collected at St. Croix by ØRSTED are to be found. ØRSTED does not give any more definite information as to where he gathered the plant. Some of the specimens reach a length of more than 12 cm; such a large specimen of ØRSTED determined by KJELLMAN is also found in Herb. ARESCHOUG in Stockholm.

Regarding an eventual change of name I refer to what is said about *Galaxaura fragilis.*

Geogr. Distrib.: West Indies, Atlantic coast of South America.

Sectio IV. ***Brachycladia*** Sonder, Kjellman, l. c. p. 67.

10. **Galaxaura marginata** (Solander) Lamx.

LAMOUROUX, J. V., Hist. Polypiers corall. flexibl., 1816, p. 264. KJELLMAN, Floridé-slägtet Galaxaura, p. 77.

Corallina marginata Solander in ELLIS and SOLANDER, Nat. Hist. Zoophytes, p. 115, tab. 22, fig. 6.

Zanardinia marginata J. Ag., Spec. Alg., vol. III, p. 534.
Brachycladia marginata Schmitz, System. Übersicht d. bisher bekannt. Gatt. der Florideen (Flora, 47, 1889, p. 438).

This species was founded upon a specimen collected at the Bahama Islands. The description of KJELLMAN on the other hand is based upon a specimen in ARESCHOUG's Herbarium in Stockholm and on which he remarks that it was collected at the coast of South America at Bahia (?). But among the material of *Galaxaura* in Herb. ARESCHOUG which I have seen, no such a specimen is present; on the other hand one is found collected by LIEBMAN at Havana and determined by KJELLMAN as *G. marginata*. Most probably this is the specimen he refers to.

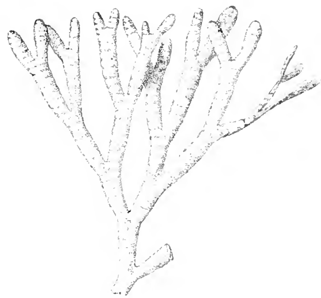

Fig. 115. *Galaxaura marginata* (Solander). Part of a plant (About 1,5 : 1).

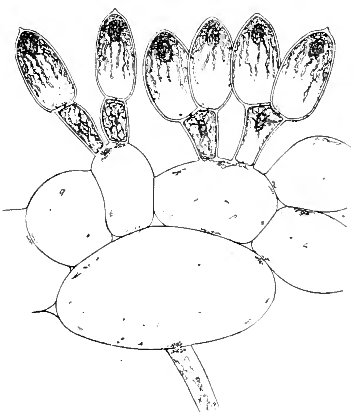

Fig. 116. *Galaxaura marginata* (Sol.). Transverse section of the periferic tissue of a form with apiculated assimilating cells. (About 250 : 1).

KJELLMAN points out that the specimens examined by him agree well with the figure of SOLANDER, and as both plants also have been collected in nearly the same area he considers himself entitled to refer ARESCHOUG's specimens to SOLANDER's species.

The rather numerous specimens (Fig 115) I have collected seem in all essentials to agree with the description of KJELLMAN. They differ from it in one respect, however, the assimilating peripheral cells ending commonly, but not always, in a short apiculus (Fig. 116), in a similar way to that described by KJELLMAN for his species, *Galaxaura apiculata* from Japan. This short api-

culus is not always present and in one specimen of mine (Nr. 1317) the mucronated assimilating cells were rare, nearly all had a broadly rounded summit (Fig. 117).

The specimens I have collected formed rather large and dense tufts composed of numerous richly ramified branches. At the base the main branches are terete or nearly so but higher up all the branches become quite flattened. They are either repeatedly forked or irregularly ramified (Fig. 115).

The colour of the dried plant is greyish to olive-green with a reddish tinge especially in the upper parts. The surface is dull and when seen under a lens finely dotted, this appearance originating from the closely placed but free assimilating cells. In this respect it differs from the *Galaxaura occidentalis*, mentioned below, this having a more even and often shiny surface while both plants otherwise show a striking remblance in their habit and where growing together.

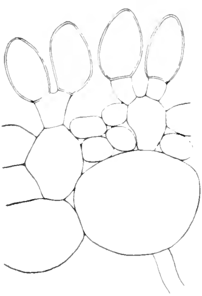

Fig. 117. *Galaxaura marginata* (Sol.). Transverse section of the periferic tissue. (About 200 : 1).

In the dried specimens the edges of the branches are often somewhat prominent giving the branches a chanelled appearance.

In my specimens the transverse striations were not much developed sometimes not at all; when present they were mostly found towards the summit of the branches (Fig. 115).

With regard to the flattening of the branches some differences are present in the various specimens. In some (my collection nr. 1317 a) a transverse section of the thallus is nearly oval, while in others (nr. 1657 b) this was oblong linear with quite parallel sides. In specimens preserved in spirit the branches are also clearly flattened (compare the branch to the right in Fig. 115) but not as much as is the case with the dried specimens; their edges are rounded and they show no trace of being channelled.

A transverse section of the thallus shows that the medullary tissue consists of irregularly, subdichotomously ramified filaments running between each other in the mucilage found here; they have rather thick walls and a diameter of about 14 μ, but both thicker and thinner are present. Outwards these filaments bear

the parenchymatous tissue (comp. Figs. 116 and 117); this consists of 2—4 layers of cells of which the innermost are the largest: the cells are nearly colourless and rather loosely connected. From the periferal smaller cells in this tissue the short assimilating filaments arise. These are composed of the smaller supporting, more or less clavate cells with proportionally broad summit and the large assimilating cells. The shape of the last mentioned is rather variable, sometimes longer, oblong-oval to subcylindric (long. = 57 μ, lat. = 27 μ) sometimes shorter, broad oval (long. = 45 μ, lat. = 30 μ) and they are mostly, as mentioned above, provided with a short apiculus. The chromatophore (Fig. 116) is well developed; it is parietal, placed in the upper end of the cells, bell-shaped, with long thin prolongations downwards along the walls of the cells. In the middle at the top of the cell it contains a pyrenoid. Also the supporting cells contain a chromatophore but lesser developed.

In the space between the supporting cells the chalk incrustation is present as an annular ring giving firmness and cohesion to the thallus. The assimilating cells protude freely over the chalk incrustation.

The material examined was sterile.

M^lle^ Vickers in her "Liste des Algues de la Barbade" reports *Galaxaura apiculata* from Barbados. I have not seen her specimens but feel convinced that she has had similar apiculated specimens before her and which I prefer to refer as explained above to *Galaxaura marginata* and not to the Japanese plant, *G. apiculata.*

This plant has been found in shallow water in a sheltered locality.

St. Croix: The Harbour of Christianssted.

Geogr. Distrib.: West Indies, Atlantic coast of South America.

Sectio V. *Vepreculæ* Kjellm.

11. **Galaxaura occidentalis** nov. spec.

G. frutescens, densa, stipitata, stipite subtereti, fronde dichotomo-ramosa, inferne subtereti, superne complanata, siccata canaliculata, sordide griseo-olivacea, membranacea, superficie inferne splendore carente, in superiori parte sæpe iridescente. Internodia in basi contracta, 2—3 mm lata. Papillæ in

fronde juveniliori numerosissimæ, rectæ, clavatæ — subcylindricæ, summo mucronatæ, ca. 40 μ longæ et 11 μ latæ.

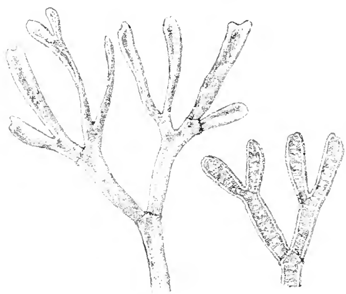

Fig. 118. *Galaxaura occidentalis* nov. spec. Parts of the thallus. The figure to the left from a specimen preserved in alcohol, that to the right from a dried specimen. (About 1,5 : 1).

The base of the plant is a broad disc by means of which it is fastened to the substratum; it consists of numerous rhizoidal filaments. These are dichotomously ramified and composed of cylindrical, nearly colourless cells, with uneven walls, about 14 μ thick.

From this basal part the erect shoots (Fig. 118) grow up in all directions. These are much branched and the ramification is more or less regularly dichotomous. In the lower part the thallus is terete but it soon grows flat; in the dried plant the edges are mostly prominent the thallus thus getting a canaliculate appearance (compare Fig. 118). The branches are about 2—3 mm broad and about 1 mm thick; the internodes taper somewhat below and are often jointed at the base. The plant preserved in spirit is not canaliculated but has broadly rounded edges.

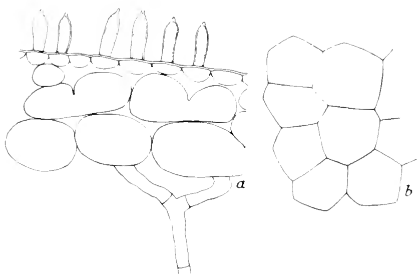

Fig. 119. *Galaxaura occidentalis* nov. spec. *a*, transverse section of the periferic tissue showing lobed cells. *b*, the lowermost cells in in the peripheric tissue seen from above. (About 200 : 1).

The colour of the dried plant has a greyish or dirty olive-brown tinge; in the lower part the surface is dull and of a mealy appearance; in the upper young parts often smooth and glossy, sometimes shining like mother of pearl and of a light greyish-yellow colour.

Cutting a transverse section we find that the thallus consists in the middle of irregularly most often dichotomously ramified cylindrical filaments which run in all directions in the mucilage found here; they have a diameter of about 8 μ but both thicker and thinner also occur.

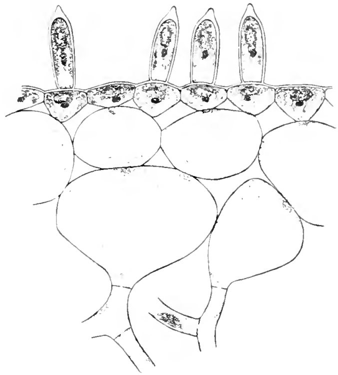

Fig. 120. *Galaxaura occidentalis* nov. spec. Transverse section of the peripheral tissue showing the campanulate chromatophores with the large pyrenoid above. Below the nucleus is maid visible by staining. (About 370 : 1).

The peripheral tissue (Figs. 119 and 120) reaches a thickness of about 90 μ, not counting the papillæ. The innermost cell-layer has the largest cells; these are rounded polygonal, rather closely united, about 70 μ broad and 40 μ high but larger and smaller ones also occur. The cells in the middle are smaller, roundish, but larger lobed cells are common (Fig. 119 *a*); the cells in this layer are about 30 μ high. Between these cells and the epidermal ones many and often large intervals are present, here the chalk incrustation especially is found forming a circular belt round the whole thallus.

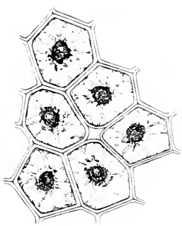

Fig. 121. *Galaxaura occidentalis* nov.spec. Epidermal cells seen from above showing the elegantly shaped chromatophore with the pyrenoid in the middle. (About 500 : 1).

The epidermal cells are closely united; they are rounded-trigonal when seen in transverse section (Figs. 119, 120), 5—7-gonal when seen from above (Fig. 121). They are about 16 μ high and their diameter varies from 18—30 μ. They have a well developed, campanulate chromatophore with a central pyrenoid (Figs. 120, 121). Also in the cell-layer below the cells have chromatophores but less developed while the innermost cells have no chromatophores at all.

Finally growing out from nearly all the surface cells we find the onecelled papillæ, characteristic to the group of *Vepreculæ*, by means of which the capacity of the assimilating tissue is so highly increased. The

papillæ (Figs. 119 *a*, 120) protrude freely over the surface of the thallus and are not included in the chalk incrustation. In shape they are clavate-cylindrical, having their largest diameter a little above their middle and then abruptly narrowed in, running out into a short apiculus. They are about 40 μ long and 11 μ broad in their broadest part. They are provided with a well developed chromatophore (Fig. 120), parietal, cuplike, with thin prolongations along the wall of the cell; in the middle a pyrenoid is present. Occasionally I have found 1—2 small cells at the summit of the papillæ which is then rounded and very rarely the upper cell was also growing out to a long one-celled hair richly filled with protoplasm at the upper end (Fig. 122).

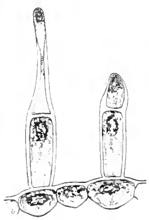

Fig. 122. *Galaxaura occidentalis* nov. spec. Papillæ growing out into hyaline hairs. (About 370 : 1).

Antheridial conceptacles (Fig. 123) were present in great numbers. They occur in the young internodes and are nearly spherical bodies with an opening through the wall of the thallus. Their wall consists of ramified filaments with larger cells growing closely together. From the innerside of these the richly ramified antheridia producing filaments grow up in the cavity. The antheridial filaments are divided into small cells of which those at the apex (but later on also the other cells) are transformed into mother-cells for the spermatia. The antheridia are about 8 μ long and 5 μ broad, oval. The antheridial conceptacles have mostly a diameter of about 200—300 μ but larger ones also occur.

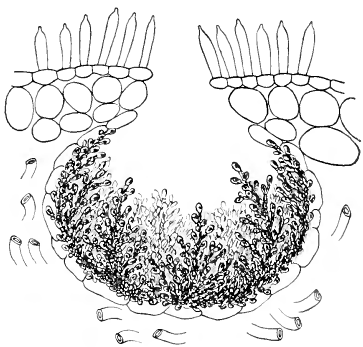

Fig. 123. *Galaxaura occidentalis* nov. spec. Transverse section of anantheridial conceptacles. (About 200 : 1).

To the sectio *Veprecula* KJELLMAN only refers four species none of which are from the West Indies. Of these *G. veprecula* Kjellm. seems to come very near to my plant. I have been able te compare my plant

with the original specimen from Madagascar and sent to KJELLMAN from E. BORNET under the name of *G. marginata*. Both plants grow in dense tufts.

But my plant is not so much incrusted with chalk, the thallus is thinner, the internodes are less broad at their base. Further *G. veprecula* differs from my species by having an entirely dull surface and by being more light yellow-green with a reddish tinge. To judge from KJELLMAN's description and figures the anatomical structure seems to come very near in both plants; but the papillæ in my plant are longer and relatively more slender than those in KJELLMAN's plant which besides have also often a roundish apex.

And *G. infirma* Kjellman from Sandwhich Island which has also the internodes somewhat narrowed differs from my plant in its thicker, dull, not shining and rather rugose thallus and by the different form of the papillæ. However, the original specimens are some small fragments and a comparison is therefore difficult.

The two other species, *Galaxaura hystrix* Kjellm. and *Galaxaura ventricosa* Kjellm. seem to show more differences.

In a paper: "Notes on the species of *Liagora* and *Galaxaura* of the Central Pacific"[1]) F. K. BUTTERS has described a *Galaxaura spec.* which seems to come very near to my plant; but to judge from the very short description some minor differences are present: the Pacific plant seems to be more distinctly contracted and jointed at the base of the internodes and the size and shape of the papillæ also show some differences.

Galaxaura occidentalis I have found only once in shallow water and in sheltered place; in the collections of algæ in the Botanical Museum, Copenhagen, two old specimens are found, one from St. Croix and another with the indication "Antillis 1836".

St. Croix: The harbour of Christiansted.

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[1]) In "Minnesota Botanical Studies", Vol. IV, part II, Minneapolis 1911, p. 183.

Fam. 3. Gelidiaceæ.

Gelidium Lamour.

1. **Gelidium corneum** (Huds.) Lamour.

LAMOUROUX, J., Essai . . . Thalassiophytes (Annales du Muséum, vol. XX, 1813, p. 128). BORNET, E., Les Algues de P. K. A. SCHOUSBOE, 1892, p. 270.

Fucus corneus Huds., Fl. Anglica, 1778, p. 585; TURNER, Fuci, vol. IV, 1819, p. 146.

var. *pinnata* (Huds.) Turner.

TURNER, l. c., p. 146, tab. 257, fig. *d*.

Fucus pinnatus Huds., Fl. Anglica, tome II, 1778, p. 586.

Gelidium cærulescens Crouan in MAZÉ et SCHRAMM, Algues de Guadeloupe, 1870—79, p. 109. COLLINS, F., The Algæ of Jamaica, p. 252. Non *Gelidium cærulescens* Kütz., Tab. Phycol. vol. 18, p. 19, tab. 56.

The plant (Fig. 124) I here refer to this species seems to agree fairly well with the above quoted figure of TURNER. It is the same which the brothers CROUAN, l. c. p. 199, have referred to *Gelidium cærulescens* Kütz. By means of an original specimen of MAZÉ et SCHRAMM's Algues de la Guadeloupe I have been able to state its identity. COLLINS has found the same plant (distributed in Phycotheca Bor. Am,, Nr. 783) in the collections of algæ from Jamaica which he has worked out and in his publication: "The Algæ of Jamaica" (Proceedings of the Amer. Acad. of Arts and Sciences, vol. 37, 1901) he calls it (p. 252) *Gelidium cærulescens* Crouan. Concerning the use of this name he adds: "By the kindness of Dr. BORNET this plant has been compared with authentic specimens from Guadeloupe, and it is the plant referred to by MAZÉ & SCHRAMM, Algues de Guadeloupe, p. 199. Whether it is the plant of KÜTZING, Tab. Phyc., vol. XVIII, pl. 56, from New Caledonia, is not certain." As it seemed to me of great interest to know how far KÜTZING's plant and that of CROUAN agreed I sent one of my specimens to M^me^ WEBER and asked her to do me the favour of comparing my plant with the type specimen in Herb. KÜTZING. M^me^ WEBER obliged me by making such comparison and she tells that there is only a single specimen in Herb. KÜTZING namely the one figured in "Tabulæ"; the specimen is much like the figure, the shade of the colour may be a little darker in this plant but that is the only difference. Further M^me^ WEBER writes: "The specimen bears tetraspores at the top of almost every branch. Can this

be the reason why all the tops are blunt? I don't know and I should want more specimens to judge the species well. As matters stands my type specimen differs from the specimen you sent me," And M^me WEBER adds that she thinks that the West Indian plant is very much like *Gelidium corneum* to which species I also think it may rightly be referred.

As mentioned above my specimens (Fig. 124) agree well with TURNER's figure of his var. *g. pinnata* yet they are somewhat smaller and often only bipinnate. The West Indian specimens too are very similar to a specimen of *Gelidium corneum* from Ceylon distributed by HARVEY ("Ceylon Algæ", No. 31).

Fig. 124. *Gelidium corneum* (Huds.) Lamour. Habit of the plant. (About 2:1).

The specimens found are about 5 cm high. The thallus is flat, reaching a breadth of about 2 mm, seldom more. The apices are blunt with a somewhat sunken growing point. The thallus is mostly bipinnate, seldom tripinnate and the ramification upon the whole is rather irregular and parts of the thallus are often destitute of branches.

A transverse section agrees with the description of HAUFE[1]). The tissue consists of a medullary layer and a cortical layer. The former consists of rather long cylindric colourless cells. The cortical layer, on the other hand, is composed of a few layers of red-coloured, short cells, radially arranged round the periphery of the thallus. Between the cells of the medullary layer the hyphæ-like filaments characteristic of *Gelidium* are found in abundance.

The material was sterile.

This species has been found only in the more sheltered places.

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1) HAUFE, Fr. E., Beitrage zur Kenntnis der Anatomie und theilweise der Morphologie einiger Florideen. Inaugural-Dissertation. Görlitz 1879.

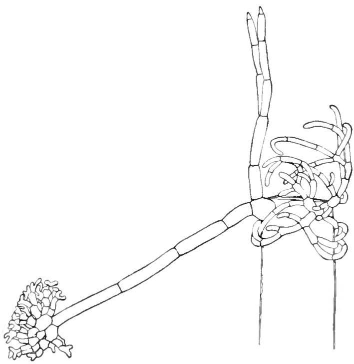

Fig. 125. *Wrangelia Argus* Mont. Disc-shaped haptera growing out from a basal cell in a ramulus found in the lowermost prostate part of the thallus. The upper large cell in the main filament is broken off. (About 150 : 1).

Wrangelia plebeja J. Ag., Spec. Alg., vol. II, pars. 3, 1863, p. 707: Epicrisis, 1876, p. 623.

This species especially differs from *Wrangelia penicillata* in its small size being seldom more than 1—1$^1/_2$ cm high, the acute ends of the filaments composing the ramuli and the lack of a dense cortical layer.

The West Indian specimens are as to their external habit much like figure 4 *f* of Montagne, l. c.

Wrangelia Argus is a littoral alga growing even in rather exposed places. It is fixed to the substratum by means of numerous, often very robust hapteræ which grow out from the basal cells in the ramuli found in the lowermost more or less prostrate

St. Croix: in several localities near Christiansted in the harbour, Long Reef, Lt. Princess.

Geogr. Distrib.: Warmer parts of the Atlantic Ocean, Mediterranean Sea, Ceylon etc.

Fam. 4. *Wrangeliaceæ.*

Wrangelia C. Ag.

1. **Wrangelia Argus** Mont.

Montagne, J. F. C., Sylloge generum specierumque Cryptogamarum, Paris 1856, p. 444.

Griffithsia Argus Mont. in Webb et Berthelot, Hist. nat. des îles Canaries, vol. III, Sectio III, Paris 1836—50, p. 176, tab. 8, fig. 4.

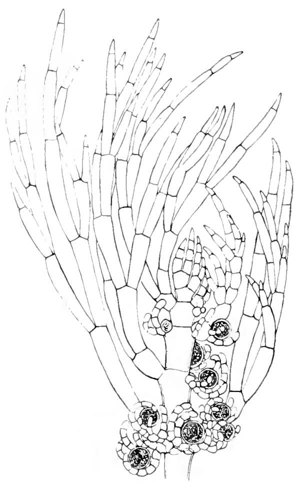

Fig. 126. *Wrangelia Argus* Mont. Upper end of a branch with ramuli and tetrasporangia. (About 80 : 1).

parts of the principal filaments (Fig. 125). As mentioned above, the large cells in the principal filaments lack a dense cortical layer, yet an attempt at this is present, as from the basal cells in the ramuli some very ramified filaments grow out and bend themselves round the large cells in the principal filaments (Fig. 125).

The cells in the principal filaments are about 225 μ broad and about four times as long.

The ramuli are more robust than those in *Wrangelia penicillata* which is the natural outcome of the littoral occurrence of this alga; the single cells of the ramuli are proportionally short and broad, the filaments become evenly narrower towards the apex and end with a short, acute, conical cell (Fig. 126).

Fig. 127. *Wrangelia bicuspidata* nov. spec. Habit of a plant. (About natural size).

In this species tetraspores only were found (Fig. 126). Like the tetrasporangia in *Wrangelia penicillata* they are terminally placed upon the ramuli and are surrounded by short filaments more closely pressed to the tetrasporangia than in *Wrangelia penicillata*. They are tetrahedrally divided and their diameter reaches about 60 μ.

In referring the *Wrangelia plebeja* of J. Agardh to Montagne's species I make this statement upon specimens determined by Agardh and collected at St. Croix by Orsted. Certainly the description of Montagne is not especially exhaustive but his figures are of much help.

This species has been found at St. Thomas: In several places in the harbour and in Store Nordsidebugt. At St. Croix it is as mentioned above collected by Orsted.

Geogr. Distrib.: West Indies. Canary Isles.

2. **Wrangelia bicuspidata** nov. spec.

Frons mediocris, ca. 7 cm alta, cæspitosa, ramosa, ecorticata vel in ramis principalibus subcorticata, in superiori et inferiori parte cellularum magnarum filis decurrentibus et assurgentibus, ex cellulis basalibus ramellorum ortis, munita.

Cellulæ in ramis principalibus permagnæ, subcylindricæ, 120 μ latæ et 10-plo longiores, in superiori parte ad genicula verticillatim ramellosæ, ramellis mollissimis, pluries dichotome divisis, a basi ad apicem leniter tenuioribus, terminali articulo generaliter bicuspidato, cellulis in parte basali ca. 50 μ latis, supremis ca. 7 μ latis.

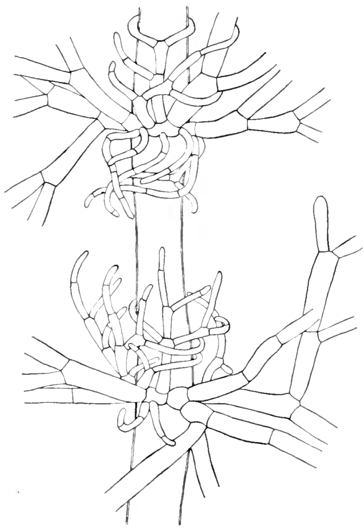

Fig. 128. *Wrangelia bicuspidata* nov. spec. Part of a main branch with the basal parts of the branchlets from which filaments grow out upwards and downwards. (About 60 : 1).

Fructificatio ignota.

All the specimens found were sterile so in referring them to *Wrangelia* I have only had the vegetative thallus to rely on, but this shows so much likeness to the other species of *Wrangelia* that I have no hesitation in referring it to this genus.

As being especially characteristic of this plant may be mentioned the fact that the cortical layer is not much developed and that the apices of the assimilating filaments mostly end in two short acute conical cells.

Wrangelia bicuspidata is a sublitoral alga growing in rather deep water, 20—30 meters or more. It is an epiphyte, as in the case of *Wrangelia penicillata* found upon different large algæ, e. g. *Caulerpa*, *Halimeda*, *Arrainvillea* etc. and is fixed to these by means of thin rhizoids growing out from the lowermost parts of the filaments.

The plant has a beautiful rosy colour and forms loose, flabby tufts up to seven cm or more in height (Fig. 127). The principal

filaments consist of very long, nearly cylindrical cells (comp. Fig. 128) about 120 μ broad and about ten times as long; these cells are thickest near the base, taper slowly upwards growing somewhat thicker again at their uppermost ends and have rather thick walls. At the upper end these long cells carry a whorl of branchlets. These are repeatedly subdichotomously ramified growing evenly thinner towards their apices which end in a single or, usually two, seldom three short conical cells (Fig. 129). From the basal cells of the branchlets several ramified filaments grow out, some upwards some downwards, bending themselves round the large cells of the principal branches (Fig. 128). In the upper parts of the branches where the cells are shorter they often cover the whole cell (Fig. 130) while in the older parts it is only the upper and lower parts which they surround. As a rule those filaments lie quite loose round the cell (compare Fig. 128).

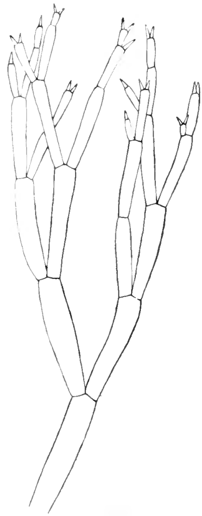

Fig. 129. *Wrangelia bicuspidata* nov. spec. Apices of branchlet. (About 60 : 1).

The branchlets are as is commonly the the case in *Wrangelia* crowded together in the upper, young ends of the branches, lower down the whorls of branchlets are more distant in accordance with the lengthening of the large central cells. In the lowermost part of the branches the branchlets fall off.

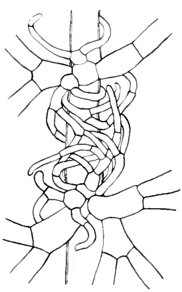

Fig. 130. *Wrangelia bicuspidata* nov. spec. Part of a young branch. (About 80 :1).

Compared with *Wrangelia Argus* our plant reminds of this species as to its loose cortical layer but differs from it in its much larger and more loosely constructed thallus and further by the bicuspidate ends of the branchlets.

And *Wrangelia penicillata* especially differs from this species by its continuous cortical layer in the principal filaments, by the blunt ends of the branchlets, by its much larger size etc.

Wrangelia bicuspidata has been found in the sublitoral region down to a depth of about 30—40 meters.

Found in several places at St. Jan in the sound between this island and St. Thomas where it seems to be common.

3. **Wrangelia penicillata** C. Ag.

Agardh, C., Spec. Alg. II, p. 138. Agardh, J., Spec. Alg. II, pars III, p. 708; Epicrisis, p. 623. Derbès et Solier, Mémoire, p. 71, pl. 18, figs. 6—8. Kützing, Spec., p. 664. Harvey, Nereis Bor.-Am., Part II, p. 143, tab. 34 B. Bornet et Thuret, Notes algologiques, Fasc. II, 1880, p. 183, pl. 48. Zerlang, O. E., Entwicklungsgesch. Untersuch. über die Florideen-Gatt. Wrangelia und Naccaria (Flora, 47, 1889, p. 371).

Griffithsia penicillata Agardh, Systema Alg., p. 143.

Dasya spinella Duby, Second mémoire sur le groupe des Céramiées, p. 13, tab. II, figs. 3, 4, 5 and tab. III, figs. 1, 2.

In the West Indian seas this plant attains a great size especially when it is growing in deep water. Several of the specimens reach a height of 20 cm or even more. The specimens growing in shallow water are smaller and more robust and more like the European specimens while the specimens from deep water are more flabby, thinner and in all respects more elongated. As to the American form see Harvey, l. c., where a description and good figures of this plant are found.

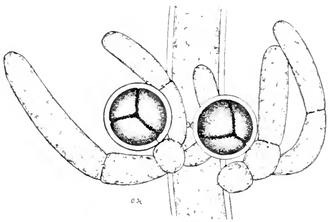

Fig. 131. *Wrangelia penicillata* C. Ag. Part of a plant with tetrasporangia. (About 200 : 1).

Zerlang has l. c. given a very detailed description of the development and structure of this plant to which the reader is referred. I shall only mention briefly that the main filaments in an early stage of development become bare at their base while higher up they carry the verticillate branchlets at each joint. From each of these whorls a smaller branch issues and these branches are regularly alternating. Some of these branches grow out into long branches and serve to form the ramification of the thallus, most of them in the sterile plant soon die away and fall off: in the fertile plant, on the other hand, they carry the organs of fertilization and last longer. The branchlets are subdichotomously branched, thin and soft. At the apices of the branches the branchlets are bent upwards and more or less cover the growing point of the branch, giving all the short branches a penicillate appearance. The ends of the filaments in the ramuli are blunt.

All the larger filaments are covered with a cortical layer (comp. Fig. 132) formed by the rhizoids growing out from the base of the branchlets; in the young parts of the branches this cortical layer is not yet developed.

The tetrasporangia (Fig. 131) of which DERBÈS et SOLIER, l. c., pl. 18, fig. 7, give a figure are placed terminally upon the short ramuli. The cells from which the tetrasporangia originate give rise also to some short filaments which are more or less curved round the tetrasporangia forming in this way a kind of involucre. The tetrasporangia are spherical, tetrahedrally divided: their diameter reaches a length of about 75 μ. The branch which carries the tetrasporangia-bearing branchlets are, as pointed out by ZERLANG, mostly without a cortical layer.

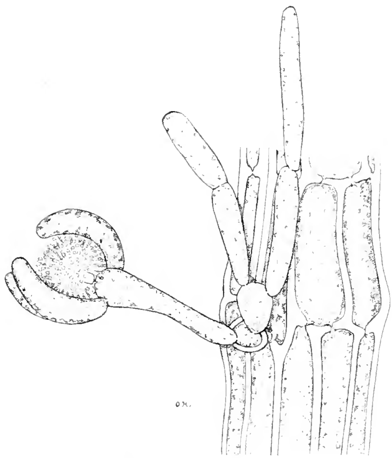

Fig. 132. *Wrangelia penicillata* C. Ag. Part of a male plant with antheridial stand. (About 200 : 1).

The antheridial stands (Fig. 132) are spherical bodies terminally placed upon the ramuli and, in a similar way as the tetrasporangia, surrounded by curved cells growing out from the cell which carry the antheridial stand. This consists of numerous short filaments radiating out from the middle of the stand and at the end of which the spermatia are formed. The diameter of the antheridial stand reaches a length of about 60 μ. DUBY has l. c., pl. II, fig. 4 given a figure of a branch with antheridial stands. In the branches which carry the ramuli with antheridial stands I have mostly found the cortical layer very well developed.

The cystocarps are spherical and terminally placed upon short branches. Regarding their shape and development upon the whole BORNET et THURET, SCHMITZ and especially ZERLANG have given detailed descriptions and the first mentioned have further given very fine illustrations, l. c., pl. 48. To these descriptions

and figures I must refer for details. The few trichogynes I have seen seem to be somewhat longer than those drawn by BORNET and ZERLANG.

The tetraspores, antheridia and cystocarps occur in separate individuals; these organs were found in the months of February and March.

This species seems to be common in the sublittoral region down to a depth of about 30 meters and is found as an epiphyte upon larger algæ, e. g. *Caulerpa*, *Penicillus*, *Udotea* etc.

St. Croix: Near Buck Island. St. Jan: in many places in the sound between this island and St. Thomas.

Geogr. Distrib.: Mediterranean Sea; the warmer parts of the European and American coasts of the Atlantic.

II. Cryptonemiales.

Fam. 1. Grateloupiaceæ.

Halymenia C. Ag.

1. Halymenia Floresia (Clem.) Ag.

AGARDH, C., Spec. Ag. I,, p. 209; Systema, p. 243. AGARDH, J., Alg. Mediterr. & Adriat., p. 96; Spec. Alg., II., p. 205; Epicrisis, p. 138. KÜTZING, Spec. Alg., p. 716; Tab. Phycol., vol. 16, pl. 88—89. HARVEY, Nereis Bor.-Am., vol. II, p. 193. BERTHOLD, Die Cryptonemiaceen des Golfes von Neapel (Fauna und Flora des Golfes von Neapel, XII. Monographie, 1884).

Fucus Floresius Clemente, Ensajo sobre las variedades, 1807, p. 312.

TURNER, Fuci, pl. 256.

Of this species I have collected a few specimens some of which are rather large reaching a length up to 40 cm. They are all very much ramified and compared with the specimens distributed in Phycotheca Bor.-Am., Nr. 298 thinner and flabbier and of a paler rosy colour. This is most probably due to their development in rather deep water. On the other hand my plants are much like a specimen from Jupiter Inlet, Florida, collected and most kindly sent to me from Mrs. G. A. HALL.

Halymenia Floresia is fixed to the substratum by means of a small disc. Immediately above this the thallus is terete, but it very soon becomes flattened and passes evenly over into the

leaf-like thin part of the thallus. This is much ramified. The branches or proliferations issue along the margin of the frond and these are again branched in the same way several times; the ultimate ramifications in my specimens are long and narrow and taper evenly against the summit.

A transverse section shows that the medullary layer is of a very loose consistency with very much mucilage between the hyphæ-like filaments of which it consists and between which thicker ones grow out in all directions. The cortical layer consists of more roundish cells; these are small, oblong-cylindrical and closely placed at the periphery, large and more loosely arranged innermost. Where the cortical layer passes over into the medullary tissue, scattered starlike cells are found with long thin prolongations, radiating in all directions and fusing together with those from the neighbour cells.

The specimens found have tetrasporangia. These occur scattered over the whole surface and are formed in the cortical layer. They are cruciately divided but often very irregular. They are about 25—30 μ long.

This species has been found in several places in the sound between St. Jan and St. Thomas in depth down to 30—40 meters.

Geogr. Distrib.: Mediterranean Sea, warmer parts of the Atlantic Ocean, Canary Island, West Indies etc.

Grateloupia C. Ag.

1. **Grateloupia filicina** (Wulf.) Ag.

Agardh, C., Spec. Alg., p. 223; Systema, p. 241. Greville, Alg. Brit. p. 151, pl. 16. Harvey, Phycol. Brit., pl. C. Kützing, Tab. Phycol., vol. XVII, pl. 22. J. Agardh, Spec. II, p. 180; Epicr. p. 153.

Fucus filicinus Wulf. in Jacquin, Collectanea, vol. III, 1789, p. 157, tab. 15, fig. 2. Turner, Hist. Fucorum, pl. 150. Esper, Icones Fucorum, pl. 67.

Grateloupia filicina is a littoral alga which commonly grows in more sheltered places in quite shallow water. Berthold[1]) points out that most of the species of *Grateloupia* found in the Gulf of Naples were found in water polluted from the town. In such places *Grateloupia filicina* also occurs in the West Indies but furthermore it is much common in quite clear water and as it is often fixed to small stones scattered upon the dazzling white coral sand it grows in very intense light. In such places

[1]) Berthold, G., Die Cryptonemiaceen des Golfes von Neapel (Fauna und Flora des Golfes von Neapel, XII Monographie, 1884).

the plant assumes an often quite bluish-green colour while in places more protected against the light its colour is a dark red-brown or red-violet; by drying the blue-green specimens assume mostly a dark red-brown colour.

The ramification is monopodial. It is a very variable plant; in some specimens the branches are long in others short, in some the length of the branches grow evenly shorter upwards in others they are longer and more vigorous upwards and much ramified. Some specimens have a proportionally broad thallus in others the filaments are nearly thread-like. In some specimens the main filament bears along its whole length rather short undivided branches. KÜTZING has figured several of these forms in his Tabulæ Phycologicæ.

A transverse section shows the structure commonly found in *Grateloupia*. The medullary layer is very loose in the middle, denser towards the periphery where it goes rather evenly over into the cortical layer. The filaments in the medullary layer are about 8 μ thick; they are irregularly subdichotomously ramified and felted between each other.

The cortical layer consists of short closely packed filaments whose innermost cells are nearly spherical, oblong to subcylindric at the periphery.

The tetraspores are formed in great numbers over the whole thallus in the cortical layer; they are cruciately divided.

The antheridia and cystocarps occur in the same plant as pointed out by BERTHOLD.

The antheridia are formed of the peripheral cells in the cortical layer as a kind of outgrowth from these; the spermatia are small spherical bodies about 4—5 μ in diameter.

The cystocarps occur more or less over the whole surface of the thallus. They are spherical bodies about 180 μ in diameter and reach far into the medullary tissue. The wall is well developed formed by filaments growing out from the auxiliary cell filaments. The cystocarps discharge by means of a pore through the cortical layer. The carpospores are densely crowded together forming a nearly spherical body. They are about 18—20 μ in diameter.

With the exception of the most exposed localities this species is common along the shores of the Danish Isles.

Geogr. Distrib.: Seems to occur in all warmer seas.

2. Grateloupia dichotoma J. Ag.

J. AGARDH, Algæ mar. Mediterr., 1842, p. 103. KÜTZING, Spec. Alg., p. 732; Tabulæ Phycologicæ, vol. XVII, tab. 28, figs. *c—e*. J. AGARDH, Epicr., p. 152.

As to their outer habit the specimens found show much likeness to the figures *c* and *d* of KÜTZING quoted above.

A transverse section (Fig. 133) of the thallus reveals the fact that the medullary tissue is very loose and open in the middle more dense outwards. It consists of thin cylindric filaments very irregularly, often stellately, branched and woven together. Their diameter is variable, often 5—6 μ thick. Towards the periphery they grow tkicker and mostly run more or less parallel with the surface of the thallus. From these filaments the cortical layer arises. This consists of short dichotomously ramified filaments placed vertically upon the surface of the thallus. The innermost cells in this layer are largest, nearly spherical, about 6 μ thick; from these is an even transition to the peripheral ones which are subcylindric about 4 μ thick and 8 μ long.

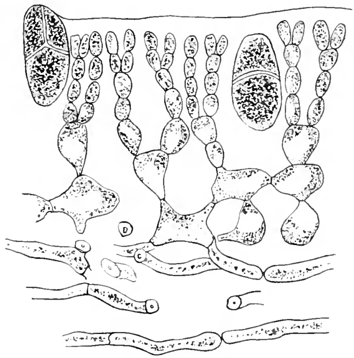

Fig. 133. *Grateloupia dichotoma* J. Ag. Transverse section of the thallus with tetrasporangia. (About 550 : 1).

The tetraspores are found in great numbers in the cortical layer over the whole surface of the thallus. They are cruciately divided and about 27 μ long and 14 μ broad.

The cystocarps occur scattered, more or less, over the whole surface of the plant. They are nearly spherical about 180 μ broad; the cells in the wall are of very irregular shape. The carpospores are formed in great quantities and are about 14 μ broad.

This species is littoral; it occurs in quite shallow water in rather exposed places where it is dashed by the waves. Like *Gr. cuneifolia* it is found abundantly in polluted water near the town but it is also found in quite clear water.

St. Thomas: The Harbour near Charlotte Amalie, the Hurrican Island.

Geogr. Distrib.: Mediterranean sea, warmer parts of the Atlantic Ocean.

3. Grateloupia cuneifolia J. Ag.

AGARDH, J., Algologiska bidrag in Öfversigt k. sv. Vetensk.-Akad. Förhandl. 1849, p. 85; Spec. Alg., vol. II, p. 181; Epicrisis, p. 154. MONTAGNE, Sylloge gen. spec. Cryptog., p, 433. KÜTZING, Tab. Phycol., vol. 17, tab. 34.

This species is a marked littoral alga. It grows together with *Ulva* etc. near the surface of the sea in places where the waves constantly dash the rocks. The thallus is tough and elastic with a glabrous and lubricous surface, very apt to grow in such localities.

The specimens collected (comp. Fig. 134) reach a length of up to 40 cm and more. They are fastened to the substratum by means of a small disc. Immediately above this the thallus is terete but it soon becomes compressed and passes evenly into the ribbon-like or leaf-like frond. This differs very much in shape, sometimes it is more narrow, sometimes broader[1]); some specimens are not divided at all but this is rare; most of the specimens are more or less lacerated or what is more common bear numerous smaller and larger proliferations along the margin. Towards the summit the thallus itself and the proliferations are evenly narrowed and run out often into long thin prolongations. The margin of the whole frond is more or less undulated. The colour is a deep red-violet.

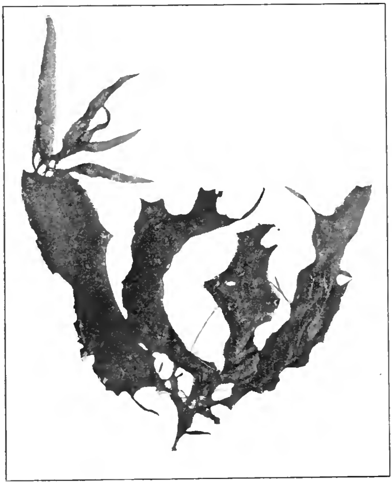

Fig. 134. *Grateloupia cuneifolia* J. Ag. A smaller much divided plant. (About half natural size).

Kützing's above quoted figure seems to me to give a fairly good illustration of the plant.

A transverse section (Fig. 135) of the thallus shows that a marked difference between the medullary tissue and the cortical layer is present.

The medullary tissue consists of more or less cylindrical much

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1) The broadest specimens in my collection are 4—5 cm broad.

ramified filaments running between each other in all directions in the mucilage found here.

In a longitudinal section it is seen that the medullary cells are very irregularly branched often more or less starlike (Fig. 136); the breadth of the cells is also very variable and this is also the case regarding the length of the cells. The development of these starlike cells is just the same as is described by Berthold (l. c., p. 2) for *Halymenia*. The filaments having got some length swell at the end and from this thickened part filaments grow out in all directions; the ends of some of these filaments meet other similar ones and fuse together with them or their ends swell and give rise to new star-like cells.

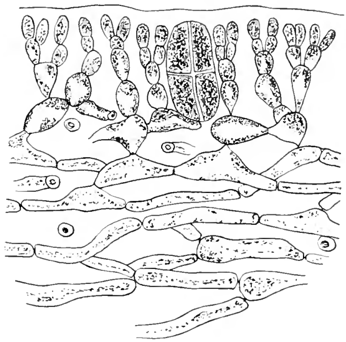

Fig. 135. *Grateloupia cuneifolia* J. Ag. Transverse section of the thallus with tetrasporangia. (About 550 : 1).

The cortical layer is composed of short dichotomously ramified filaments. The innermost cells in these are the largest and more irregularly shaped, the outermost small oval to subcylindrical 8—9 μ long and about 3 μ broad and rather closely packed together.

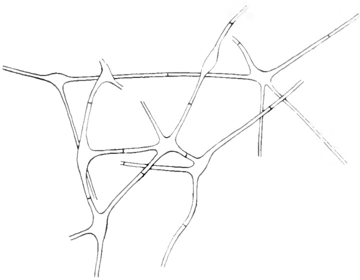

Fig. 136. *Grateloupia cuneifolia* J. Ag. Star-like cells from the medullary layer. (About 250 : 1).

The tetrasporangia (Fig. 135) are formed in the cortical layer and occur scattered over the whole surface of the thallus. They are cruciately divided about 30 μ long and 19 μ broad.

Among the dried specimens a single cystocarpic one was found. While the tetrasporic specimens have quite a smooth sur-

face the female plant has a very uneven warty surface. The cystocarps are found spread over the whole thallus; they are placed rather deep in the medullary tissue, are nearly spherical and open by means of a pore through the cortical layer. Plants with tetraspores and cystocarps were met with in the months December to March.

This species has only been found in very polluted water at the town Charlotte Amalie.

St. Thomas: The harbour.

Geogr. Distrib.: West Indies.

Fam. 2. Rhizophyllidaceæ.

By Mme A. Weber-van Bosse.

Contarinia Zanardini.

1. **Contarinia Magdæ** nov. spec.

Thallus totus substrato adhærens, ad basin calcareus, constans hypothallo et perithallo. Hypothallus constat filis ramosis, parva flabella efficientibus. Perithallus constat filis erectis, dichotomis, quorum cellulæ peripheriam versus decrescunt.

Cellulæ altæ 40, 20, 12 μ, latæ 20, 16, 12 μ.

Tetrasporangia in soris ex apice fili transformata, clavato-obovata, irregulariter cruciatim divisa; alta 36, 40 μ, lata 16, 20 μ.

Contarinia Magdæ[1]) is the first alga of this genus collected in the West Indies were it was gathered by Dr. Th. Mortensen in the "Sound" between St. Thomas and St. Jan. It is growing on and entirely enveloping a hard mass of small stones and coral that had a diameter of 3 cm. Of its colour it is impossible to judge for the specimen is preserved in alcohol. It is distinguished from *C. Peyssonneliæformis* by its frond, calcified at the base and only free from carbonate of lime in its upper part, whereas the whole frond of *C. Peyssonneliæformis* is fleshy (carnosa). The size of the cells shows another difference between the two algæ: the cells of *C. Magdæ* have a breadth of rarely 40, mostly 20 μ, at the base, diminishing towards the periphery where they measure often 20 and even 16 and 12 μ. The height of the cells at the base and the middle of the filament is sometimes 2 — mostly $1^1/_2$ as high

[1]) So called in honour of Mrs. Børgesen, the graceful wife and companion of the explorer of the Danish West-Indian islands.

as broad or isodiametric; towards the periphery the cells are, as a rule, as high as broad or a little less. Seen from above the peripheral cells have a diameter of ± 20 μ. The cells of *C. Peyssonneliæformis* have a breadth of 20—12 μ at the base, lessening upwards to 8 and to 5 μ at the top; they are from $1^1/_2$ to 4 times as high as broad.

The vertical rows of cells of *C. Magdæ* loosen themselves from each other under very slight pressure after decalcification and only their basal cells remain fastened together. This will probably be in consequence of the disappearance of the carbonate of lime. There are lateral pores between the cellrows, but the pores are very delicate and do not tend to make the frond much firmer. *C. Peyssonneliæformis* has no carbonate of lime between its cellrows, which do not loosen themselves from each other under slight pressure; the frond is soft and fleshy to the touch after having been moistened.

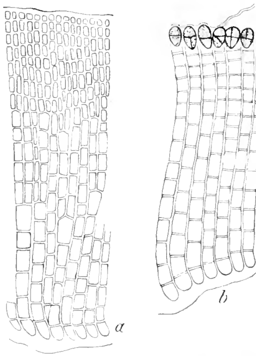

Fig. 137. *Contarinia Magdæ* n. sp. *a.* section through vegetative part of thallus in full growth, with the cells in the higher part dividing repeatedly. *b.* section through part of a sorus with tetrasporangia at the top of the filaments. (120:1).

The tetraspores of *C. Magdæ* are born in sori at the top of the vertical cell-rows (Fig. 137); they divide in a cruciate way, but the divisions are often irregular and sporangia with two and three spores only, are not rare. They are covered by a pretty firm cuticula, that seems to tear off at maturity of the spores. The sporangia have a height of 36—40 μ and a breadth of 16—20 μ.

Found in the "Sound" between St. Thomas and St. Jan by Dr. Mortensen.

Fam. 3. Squamariaceæ.

By Mme A. Weber-van Bosse.

When treating of the *Squamariaceæ* of the "Sealark" expedition, I divided the *Peyssonnelia* into three subgenera: 1. *Peyssonnelia* s. s. or *Eupeyssonnelia* with a hypothallus consisting in the main of straight filaments, running close to one another in a horizontal

direction over the substratum (Fig. 138), 2. *Cruoriella* with a hypothallus of curved filaments running in little fan-shaped or broad-lanceolate groups over the substratum (Fig. 139) and 3. *Ethelia* with no hypothallus but a mesothallus that gives off branches both downward and upward. This division proved very useful while working out the *Peyssonnelia* of Dr. Børgesen. In his collection species of *Peyssonnelia* and *Cruoriella* are numerous but the subgenus *Ethelia* is wanting, it has till now been only found in the East-Indian seas and in the Mediterranean. *P. squamaria*, the well-known inhabitant of the last-named sea, has a true mesothallus though the perithallus inferior is reduced to only one layer of cells.

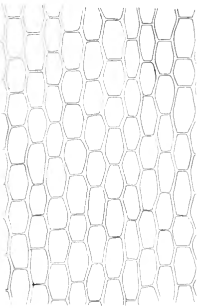

Fig. 138. *Peyssonnolia simulans* n. sp. Straight running filaments of the hypothallus. (160 : 1).

It is a well-known fact that algæ have a great variability and in how far the *Peyssonnelia* are subject to this general law, is still an open question, for this group of plants has relatively been little studied. We know that the circular or lobed fronds can be membranaceous *(P. rubra)*, coriaceous *(P. squamaria)*, or calcareous and hard as stone *(P. polymorpha)*, but there are also other forms not entirely calcareous neither coriaceous; we will have to speak of such a species in the following pages.

A frond will, as a rule, increase in thickness by successive division of its ascending filaments, but in the group of *P. (Cruoriella) polystrata* we find a thick frond consisting of layers of narrow fronds lying one above the other, creeping continually over each other and forming a thick frond by this mode of growing. Again in another species the frond, after having acquired a certain thickness, splits or tears in a horizontal direction; the lower part decays little by little, the upper part continues the growth of the frond; its inferior cells grow larger, produce rhizines and develop the characters of an ordinary hypothallus. Such a young thallus, after having acquired the necessary thickness, will split in its turn; I have seen

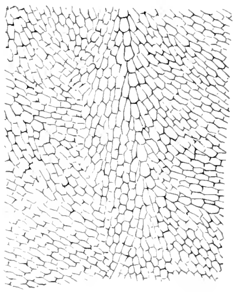

Fig. 139. *Cruoriella armorica*. Crn. Filaments of the hypothallus forming little fanshaped groups. (90 : 1).

two and three remnants of old thalli underlying a young one. It is curious that the old thalli decay in this species, whereas in *P. (C.) dura* — the type of HEYDRICH's *Polystrata* — all the thalli are preserved. This depends, as I believe, on the fact that *P. (C.) dura* has a calcareous frond and that *P. (C.) Nordstedtii*, as we will presently see, is mostly of soft texture with only little calcareous matter distributed throughout the frond.

The anatomical structure of the *Peyssonneliæ* is much alike; it consists, as we know, of creeping filaments — the hypothallus — and each cell of these filaments gives off, seen on longitudinal sections, an obliquely ascending filament, these constitute the perithallus. The cells of the perithallus differ in heigth and breadth in different species, but still these characters are to be used very carefully, for the size of the cells will vary in the same specimen according to the spot where the section is made and according to the age of the plants. On the other hand, when studying many species of this genus, we find different species with cells of almost the same size. Searching for a character that might help to distinguish the puzzling species, I was struck with the fact that the topcell or apical cell divided differently in some species, though these divisions corresponded essentially with the divisions of *P. (Eup.) squamaria*.

The anatomical structure of this alga has been, as we well know, the object of careful research by NAEGELI[1]), who has also given good figures to show, how the filaments of the hypothallus, seen from above, divide dichotomously to increase their number, according to the fan-shaped growth of the frond.

The longitudinal growth of the filament that interests us for the present, depends upon the partition of the apical cell by a more or less oblique membrane on its longitudinal axis. In *P. (Eup.) squamaria* and — as far as I can judge — in most species, this apical cell is relatively high (in vertical direction) and horizontally short. After division, the outermost segment grows on, until it has reached its former size and then divides again. The inner segment increases also in size, it may divide again by a vertical cellwall, though this is rarely the case; as a rule it divides, after having attained a given size, by a horizontal wall into two unequal portions of which the uppermost is destined to become the mothercell of the ascending filament and the inferior constitutes part of the hypothallus. This inferior cell may be less high than the superior one (*P. (Eup.) squamaria*) or

[1]) NAEGELI, Die neueren Algensysteme, 1847, p. 248.

it may be higher (*P. (Eup.) simulans*), but it is always less high than the apical cell (Fig. 140).

In a few other species (*P. (Eup.) rubra*) the topcell or the cells following may be longer than high; it divides just like the short one by an oblique cellwall on its longitudinal axis into two segments. The outer one grows until it has reached its former size and then divides again. The inner segment will grow too, and may first divide again by a vertical cellwall; if this is the case, the third or even the fourth cell after repeated division, increases in height and then divides by a horizontal wall into two often unequal portions. The inferior one retains the height it had at the moment of division of the apical cell; it communicates with its neighbouring hypothallic cells of the same filament through the primary central pore; the upper portion is the mother cell of the ascending filaments. I thought at first that these differences in growth of the apical cell might coincide with the branching of the hypothallus, but this is not the case. I have found the short, high apical cell in species belonging to the subgenus *Eupeyssonnelia* as well as to the subgenus *Cruoriella* and in both subgenera the longer and less high apical cell. Therefore I consider this character only useful as a specific one, but as a good one, for great as the variability of the *Peyssonnelia* may be, I can not imagine that a topcell as in Fig. 140 can grow into a topcell like Fig. 144.

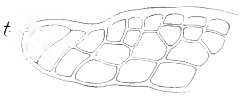

Fig. 140. *Peyssonnelia (Cruoriella) simulans* nov. spec. Section throug the margin of thallus. *t.* topcell or apical cell; the one row of inferior cells constitute the hypothallus, the ascending, still short cellrows, the perithallus. (200 : 1).

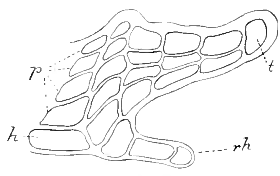

Fig 141. *Peyssonnelia rubra* (Grev.) J. Ag. A longitudinal section through margin of thallus. *t.* topcell; *p.* perithallus; *h.* hypothallus; *rh.* rhizoid. (360 : 1).

When treating of the *Peyssonnelia* of the Siboga Expedition, I hope to be able to give some more details about the growth of the apical part of these algæ, but this study is very tedious, for dried specimens have the margin often crumpled or broken off. It is also difficult to get good longitudinal sections and the topcell must be in a growing stage. In old fronds, when their maximum size is reached, the topcells cease growing in radial direction but they may still divide in another way and slides made

unfortunately through a thallus in such a state, will only add to the confusion.[1])

The fruit of the *Peyssonnelia* are nemathecia with carpospores and tetraspores raised above the surface of the frond. By these nemathecia the *Squamariaceæ* are easily known from the *Melobesiaceæ* which they resemble so much in anatomical structure. SCHMITZ[2]) described the development of the procarp and the auxiliary cells in *Peyssonnelia* but he gave no figures and it is highly desirable that his investigations should be repeated. It is, however, very difficult to obtain good material. The collection of Dr. BØRGESEN contains only nemathecia with carpospores and tetraspores.

But nemathecia with ripe carpo- or tetraspores are also a character of importance when describing new species. While studying the Siboga material I had ample occassion to appreciate their value, but the specimens collected by Dr. BØRGESEN are more uniform in this respect than the East-Indian species.

The collection of Dr. BØRGESEN is rich in *Peyssonnelia.* MAZÉ et SCHRAMM in their "Les Algues de la Guadeloupe" mention only *Peyssonnelia Dubyi* and MURRAY in his "Catalogue of marine algæ of the West-Indian region" knows of no other representative of this family. It is therefore not strange that Dr. BØRGESEN's collection contains many novelties but, alas, also some plants about which I feel uncertain. These algæ resemble well-known species but are not exactly like the type-specimens; if now the

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[1]) Continuing my research on the apical cell of the *Peyssonnelia* after having finished this paper, I observed a stage of rest in the thallus of *P. rubra,* followed by a period of intense growth. A section through the margin in a state of rest, gave a figure resembling the figure of *P. Boergesenii* (Fig. 144). On this period of rest followed a period of growth in which the topcell and the cells immediately following it, wore different aspects in succeeding longitudinal sections. I think that these succeeding stages of growth and rest correspond with the concentric lines and smooth zones we observe in the thallus of *P. rubra* that has, as we know, a turned up margin. The spot from where the new growth begins, is attached by rhizoids to the substratum; the young frond curves distinctly upwards but by succeeding growth it stretches itself horizontally and will afterwards attach itself to the substratum. I suppose that the concentric lines on the thallus coincide with the spot from where the new growth begins, and which carries many rhizoids. The intervening zones between two concentric lines have as a rule far lesser rhizoids.

[2]) SCHMITZ, Untersuchungen über die Fruchtbildung der *Squamarieen,* Sitzungsber. d. niederrh. Gesell. Bonn, 1879, p. 376.

material was scanty or the specimen sterile, I queried these doubtful specimens and placed them near to the species which they most resemble, leaving it to future investigators to decide whether they are forms of the type — or new species.

One specimen belongs probably to the genus *Cruoriopsis*, but it is in such incomplete state, that it cannot be identified with certainty.

Besides the easily known and doubtful species the collection of Dr. Borgesen contains:

two new *Cruoriella*,
one new *Peyssonnelia* and
one new *Contarinia*, of the family of the *Rhizophyllidaceæ*.

Before giving the systematic list of the species, I may perhaps add a few words to express my sincere thanks to Dr. Borgesen, for entrusting me with his collection and to Mr. Hariot of the Muséum d'Histoire Naturelle de Paris, for his kind help in sending me valuable specimens for comparison.

Cruoriopsis Dufour.

1. **Cruoriopsis** spec.

One of the small specimens in the collection of Dr. Borgesen carries at the top of the ascending filaments two short files of moniliform cells of peculiar aspect; they remind one of the carpospores in the cystocarps of *Cruoriopsis cruciata*. The cells are, however, still very young and I have seen no other organs of fructification. I do not dare to name this alga with certainty but I think it likely, that it is a member of the genus *Cruoriopsis*.

Found at St. Thomas, in the harbour at the French Wharf. (N. 52). Dry Specimen.

Peyssonnelia Dec.

Key to the subgenera and species of *Peyssonnelia* from the West-Indian region, collected by Dr. F. Borgesen.

I. Thallus procumbent, more or less firmly adhering to the substratum, orbicular or irregular in outline, with a hypothallus consisting of dichotomous filaments, running from the centre towards the periphery and form-

ing small, lanceolate, fan-shaped groups. From the cells of the hypothallus rise more or less obliquely ascending filaments: the perithallus. . . Subgenus *Cruoriella.*

a. Thallus hard, calcareous, firmly adhering to the substratum.

1. Thallus very thin, when decalcified easily detached from substratum and so small that it can be expanded in toto on a slide; colour dark pink. *P. armorica* Crn.
2. Thallus much firmer, surface slightly marked with small low elevations, sometimes with radial lines but no veins; perithallus with an inferior part of large cells and a distinct superior part with small cells; colour dark pink . . . *P. Dubyi* Crn.
3. Thallus very firm, surface smooth but with distinct veins running from the centre towards the periphery; perithallus with cells often almost isodiametric except the basal large and the superior small ones. Colour dark purple with a green hue. . . . . *P. Boergesenii* nov. spec.

b. Thallus fleshy, slightly calcareous at base, firmly adhering to substratum and tearing in horizontal direction after having acquired a given thickness. Inferior cells of the upper, torn off, part transform into a new hypothallus; colour probably pink . . . *P. Nordstedtii* nov. sp.

II. Thallus procumbent, adhering more or less firmly to the substratum, orbicular or irregular in outline, with a hypothallus consisting of in the main straight, juxtapposed, dichotomous filaments, running from the centre towards the periphery, giving rise to more or less obliquely ascending filaments: the perithallus. . . . . Subgenus *Eupeyssonnelia.*

a. Thallus hard, calcareous, with short, high apical cell.

1. Thallus thin, consisting of 6, 7 layers of cells, easily detached from substratum, mostly orbicular with radial lines; colour light pink . . . . *P. simulans* nov. sp.
2. Thallus more robust, firmly adhering to the substratum, colour purple. . . . . *P. conchicola* Picc. et Grun.

3. Thallus very firm, easily loosened from the substratum, irregular in form; perithallus with inferior part of large cells, superior part with smaller cells; colour brick red. . . . . *P. polymorpha* (Zan.) Schm.

b. Thallus membranaceous-calcareous with long apical cell as high as hypothallic cells, orbicular with slight radial lines and concentric zones; colour pink or red. *P. rubra.*

Subgenus 1. *Cruoriella* Crn.

1. Peyssonnelia (Cruoriella) armorica (Crn.).

Cruoriella armorica Crouan in Ann. Sc. Nat., 1859, 4e série. t. 12; Flor. du Finist. 1867, p. 148, tab. 19, fig. 128. De Toni, Syll. Alg. vol. IV, 1905, p. 1691.

This small alga was detected growing on other *Peyssonnelia*. Thanks to the extreme kindness of M. Hariot, assistant au Muséum d'Histoire Naturelle at Paris, I was able to compare it to an authentic specimen of Crouan. The comparison showed the absolute identity of the two specimens.

Found at St. Thomas in the sea to the west of Water Island in a depth of about 15 fathoms. In alcohol. (No. 1110 III).

Geogr. Distrib.: Atlantic coast of Europe, Mediterranean Sea.

2. Peyssonnelia (Cruoriella) Dubyi Crn.

Crouan, Ann. d. Sc. Nat. 1844, p. 368, tab. 11. Schmitz, Uebers. der Florideen, 1889. p. 20. De Toni, Syll. Alg. vol. IV, sect. IV, 1905, p. 1691.

Peyssonnelia Dubyi belongs to the subgenus *Cruoriella* because its hypothallus consists of fan-shaped little groups of filaments. These filaments have in horizontal direction a short and in vertical direction a high apical cell, higher than the cells in the hypothallic filaments.

P. Dubyi was the only known Squamariacea of the West-Indian region before Dr. Børgesen's Expedition.

Found at St. Thomas in the sea to the west of Water Island in a depth of 15 fathoms. (N. 1030). Dry specimen.

Geogr. Distrib.: Atlantic coast of Europe.

3. **Peyssonnelia (Cruoriella) Boergesenii** nov. spec.

Thallus totus adnatus, valde calcarius, superficie levi cum singulis venis conspicuis, e centro ad peripheriam currentibus, constans hypothallo et perithallo. Hypothallus constat filamentis repentibus, juxtappositis, flabella angusta, elongata, efficientibus. Cellula apicalis longa; cellulæ filamentorum hypothalli æque altæ aut altiores ac cellulæ apicales.

In speciminis juvenilibus omnes cellulæ filamentorum repentium fere æquales, in speciminis adultioribus axis principalis conspicuus, cellulis majoribus.

Perithallus divisus in partem inferiorem, cellulis magnis, tetragonis aut $1^1/_2$ altioribus quam latis, altis 40—36 μ, latis 40—36—20 μ et in partem superiorem, cellulis gradatim decrescentibus. Cellulis periphericis multo brevioribus quam latis, altis 10 μ, latis 20 μ.

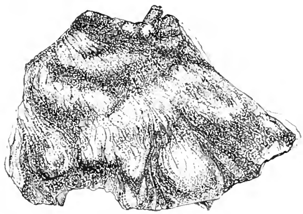

Fig. 142. *Peysonnelia Boergesenii* nov. spec. Surface view of the plant. $\times$ 1,6.

Nemathecia cum carposporis quadripartitis zonatis, paraphyses cellulis longioribus quam latis, altis 40—36—16—12 μ, latis 6—8—12 μ et cellulis apicalibus moniliformibus. Nemathecia cum tetrasporangiis ignota. Thallus altus $\pm$ 500 μ, nemathecia 240 μ.

Peyssonnelia (Cruoriella) Boergesenii[1]) (Fig. 142) distinguishes itself by its smooth surface marked with delicate but distinct veins, visible to the naked eye and running in a fan-shaped direction from the centre towards the periphery. These veins are quite different from the radial lines, we observe f. i. in the thallus of *P. rubra* and depend probably upon the axis with large cells of the hypothallus. In a dried state the colour of the thallus is very striking owing to the greenish hue of the dark purple frond.

In the collection of Dr. Børgesen are four numbers from the same locality that I believe belong to this species, though in structure they show some differences, but these differences depend on the age of the individuals. Seen from below No. 1442

[1]) I have great pleasure in dedicating this alga to Dr. Børgesen, the botanist and explorer of the marine flora of the Danish West-Indies.

has a hypothallus with cells of the same size, whereas No. 1546^{II} seen from below, has a hypothallus with cells of different size constituting a principal axis of larger cells from which spring files of smaller cells, that form together groups, like elongated little fans.

The frond of No. 1546^{II} is rather thick, it must be an old plant and I think that by succeeding growth, changes in the basal layer of the frond have taken place. Only too often, when studying *Peyssonnelia*, one sees that the basal layer undergoes changes, and these can ultimately tend to the solution and even disappearance of part of the hypothallus. In *P. Boergesenii* the

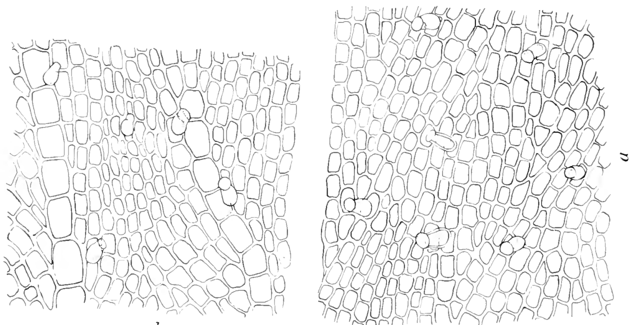

Fig. 143. *Peyssonnelia Boergesenii* nov. spec. View of two hypothalli, loosened from the substratum. *a.* (No. 1442) young hypothallus. principal axis not yet differentiated. *b.* old hypothallus with distinct principal axis. (No. 1546^{II}). (210 : 1).

hypothallus is not soluted; the cells of the principal axis increase simply in size.

The apical cells is long and as high as or less high than the cells of the basal layer (Fig. 144)[1]) and in this respect *P. Boergesenii* differs from *P. Nordstedtii* that has a high, short apical cell, like Fig. 140.

The perithallus (Fig. 145) consists of a lower part of almost square cells, high $\pm 40\mu$, on which follows an upper part with

[1]) The section after which this figure was made, did not quite satisfy me; I fear that it is a section throug a margin no longer in a growing state, but I could get no better for the margin of the alga was very much broken off. This section shows, however, that the apical cell is not a high, short one.

cells higher than broad, diminishing regularly towards the periphery, the peripheral ones being the shortest of all: height 10μ, breadth 20μ. This succession is, however, not always so striking as told here.

The frond can easily attain a thickness of 500μ, even more, for my sections do not run through the thickest part of the frond.

Fig. 144. *Peyssonnelia Boergesenii* nov. spec. Section through dried margin of thallus. *t*. topcell. (380 : 1).

The cells contain much granules, that take at first a golden brown colour by hydrochloric zinkiodine and become almost black under long influence of the reagens.

I have only seen one nemathecium with carpospores. It had a darker colour than the frond, was elevated above its surface and irregular in form; it had a height of 240μ and the quadripartite, zonate carpospores of 160μ, but these looked as if they were not yet quite ripe. The paraphyses ended in a short, round cell, not in a broad blunt one (Fig. 145, *a*).

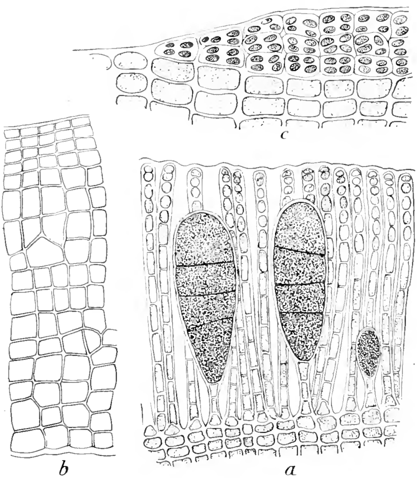

Fig. 145. *Peyssonnelia Boergesenii* nov. spec. *a*. section through nemathecium with carpospores; *b*. section through thallus in transverse direction; the inferior cells are sometimes larger when the section hits upon a principal axis of the hypothallus; when the section is made in longitudinal direction the inferior cells ascend obliquely. (250 : 1). *c*. section through nemathecium with antheridia. (540 : 1).

Nemathecia with antheridia were more frequent; I found them on the same plant as the carpospores (Fig. 145 *c*).

This *Peyssonnelia* resembles *P. Harveyana* very much with

regard to its anatomical structure, but it differs from this alga by its hypothallic filaments, running in little flabelliform groups over the substratum; the colour of both algæ is also different, *P. Boergesenii* being of a dark purple colour with a greenish hue over it, *P. Harveyana* of a bright red colour. Lastly *P. Boergesenii* is also characterized by the distinct veins running from the centre towards the periphery.

Found in shallow water, St. Croix, White Bay. (N. 1537 II, 1546 II, 1585 II). Rust of Twist (N. 1442). In alcohol and dry specimens.

4. **Peyssonnelia (Cruoriella) Nordstedtii** nov. spec.

Thallus tota superficie inferiore adhærens, paulum calcarius, colore ignota, diametro usque ad 4 centimetrum, constans hypothallo et perithallo. Hypothallus constat filis repentibus, juxtappositis, parva flabella efficientibus. Cellula apicalis filorum alta et brevis, in sectione longitudinali altior filis hypothalli.

Cellulæ longæ 28—36—40 μ, latæ 16—20—28 μ et $\pm$ 28 μ altæ.

Perithallus constat filis adscendentibus, stratum satis crassum, denique fissum formantibus. Pars inferior hujus strati perit, pars superior hypothallum novum efficit, cum radiculus uni- et pluricellularibus partem inferiorem tegente, radiculis iis in partem inferiorem penetrantibus.

Cellulæ altæ $\pm$ 12—20—36 μ, latæ 12—16—20 μ. Nemathecia cum tetrasporis quadripartitis, cruciatis, tantum immatura visa.

Peyssonnelia (Cruoriella) Nordstedtii[1]) resembles an alga collected at the island of Nias, Sumatra, that I have called in my manuscript of the Siboga-algæ, later on to be published, *P. Nordstedtii*. Both algæ have in common a frond of soft texture, only slightly incrustated with carbonate of lime and the peculiar way of renovating the frond.

P. Nordstedtii belongs to the subgenus *Cruoriella* on account of its hypothallus consisting of filaments branching by repeated dichotomy, which branches grow until other filaments, crossing their way, stop their growth. The branching filaments form little elongated fan-shaped groups, springing from a principal axis with larger cells than the cells in the fan-shaped groups, just like what we have seen in *P. Boergesenii* (Fig. 143).

Characteristic of *P. Nordstedtii* is the way in which the peri-

[1]) Named in honour of and in gratitude to Prof. O. Nordstedt at Lund, the learned algologist, to whom I owe so many graceful acts of kindness.

thallus may tear horizontally after having acquired a thickness of 11 cells or more. The inferior 4—5 cells are the largest, the cells higher up are smaller in diameter, and the peripheral cells are the shortest of all.

Between the inferior large cells and the succeeding ones, which are somewhat smaller, the membrane thickens. This thickening of the membrane takes place in horizontal direction, and may spread over some distance. In this thick membrane appears at first a slight opening, this enlarges, tears the membrane horizontally and divides the perithallus into a superior and inferior part; these can remain jointed but very often they tear asunder.

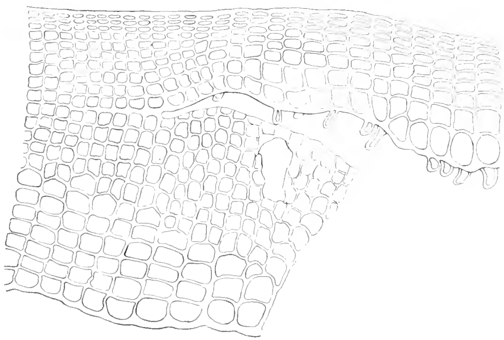

Fig. 146. *Peyssonnelia Nordstedtii* nov. spec. Section through thallus in transverse direction in the moment that the upper part tears itself from the partially decaying inferior part. (210 : 1).

In either case the upper part will increase in thickness and its inferior cells increase in size, and then the membrane will again thicken at the same place as formerly, above the four or five layers of large cells. If the perithallus is not torn, we see the succeeding layers forming one continuous mass.

But often the perithallus splits into two layers; if this happens we observe first a little opening in the thickened membrane, this enlarges quickly and divides the perithallus into two parts (Fig. 146).

The upper part transforms its basal cells, that were formerly in the middle of the ascending filament, into a young hypothallus, with uni- and pluricellular rhizines that penetrate in the inferior part of the perithallus.

The cells of this inferior part are filled with grains of starch, yet they will die or dissolve little by little; it may also be that the rhizines get some nourishment out of them.

In sections I have often seen three layers of thalli one above another. By these superposed thalli *P. Nordstedtii* approaches the group of *P. polystrata* of which *P. dura* Heydr. is the type. The name *dura*, given on account of the hard calcified nature of the frond, is alone sufficient to show that our alga with its soft frond, is a different species, not to speak of other differences, afforded by the peculiar structure of the nemathecium of *P. dura*.

I have seen only one nemathecium of *P. Nordstedtii* with cruciate tetraspores, but it was still unripe. It had a height of 80 μ, and the paraphyses ended with a blunt cell; the cells were $1^1/_2$—2 as long as broad but this will change with succeeding growth.

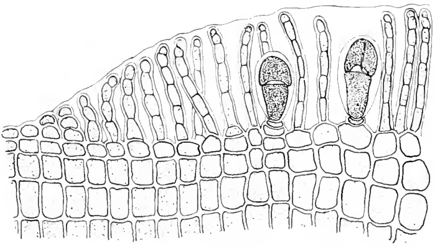

Fig. 147. *Peyssonnelia Nordstedtii* nov. spec. Section through part of nemathecium with cruciate tetraspores. (250 : 1).

P. Nordstedtii adheres totally and firmly to the substratum. I cannot say anything about its colour for it was preserved in alcohol and I have seen no dry specimens from the W. Indies.

The specimen from Nias that has so much in common with the W. Indian one, has a pale pink colour.

Found at St. Jan off Cruz Bay in a depth of about 12 fathoms. In alcohol. (No. 1903).

Subgenus 2. *Eupeyssonnelia.*

5. Peyssonnelia (Eupeyssonnelia) simulans nov. spec.

Thallus tenuis, orbicularis aut irregularis, substrato tomento brevi adhærens sed facile a substrato solutus, durus, calcarius, zonas concentricas et lineas radiales vix conspicuas exhibens, constans hypothallo et perithallo.

Hypothallus constat filis rectis, juxtappositis, cellula apicali brevi, lata instructis. Cellula apicalis in sectione radiali altior filis hypothalli.

Cellulæ longæ 20—28—32—40 μ, latæ 16—20 μ, in sectione altæ 20—24 μ.

Perithalli cellulæ infimæ omnes fere æque altæ ac cellulæ hypothalli; in sectione transversali altiores quam latæ, in sectione longitudinali fere quadraticæ, cellulæ superiores gradatim decrescentes.

Cellulæ altæ 24—28 μ, latæ 20 μ.

Nemathecia in thallo parvas maculas obscuras irregulares efficiunt, carposporis tripartitis zonatis et paraphysibus obtusatis quorum cellulæ $1^1/_2$ altiores sunt quam latæ.

Nemathecia alta 200 μ. Carposporæ 100 μ. Nemathecia cum tetrasporangiis, cruciatim divisis. Tetrasporæ altæ 60—80 μ.

Peyssonnelia simulans has received its name because it has so many points in common with *P. conchicola* that I felt doubtful, whether it might not be a form of *P. conchicola* but it can not be identified with this alga and therefore I prefer to describe it as a new species.

P. simulans distinguishes itself from *P. conchicola* by adhering loosely to the substratum; the collection of Dr. Borgesen contains entire loosened specimens, whereas *P. conchicola* adheres firmly to the substratum. The colour is different in both algæ, *P. simulans* being of a bright pink colour — not red — and *P. conchicola* of a red colour that fades partially away in drying. The faded parts have a yellowish pink colour.

It is true that as a rule colour is a bad characteristic of algæ but in the *Peyssonnelia* it is such a marked feature, that it probably can be of great help in knowing the different species.

P. simulans resembles *P. conchicola* by its hypothallus consisting of straight-running filaments ending in a short, high apical cell, which is higher than the filaments are at a little distance from the top. Its perithallus is characterized by an almost square lower cell, that divides at its top, seen in longitudinal section, in two rows of cells (Fig. 140). This is often the case in species of *Peyssonnelia* but seldom so regularly and in such a marked way as in this species. Under slight pressure on the cover slip, the cellrows loosen in vertical direction after decalcification and this I have never observed in sections of *P. conchicola*. I could study this alga thoroughly thanks to the kindness of Dr. A. Forti, who send me an authentic specimen of Dr. Piccone for comparison. I may well thank him here for his kindness.

The thallus of *P. simulans* is incrustated with carbonate of lime; it is thin, the thickest thallus in Dr. Borgesen's collection

has no more than five or six layers of cells and thalli with three layers of cells carried even nemathecia with tetraspores. A specimen (No. 1110^{II}) preserved in alcohol, carried nemathecia with tripartite, zonate carpospores (Fig. 148); one layer of cells under the nemathecia was exceptionally high in another plant. Some plants have a thick basal layer of mucuous substance, but this character is not constant.

To sum up the differences between *P. simulans* and *conchicola* we find that *P. simulans* has a lighter colour, does not adhere to the substratum and that it must carry more carbonate of lime in its tissue for, after decalcification, the cells loosen easily from each other in vertical direction. The contents of the older cells, consisting principally of grains of starch in *P. simulans* are more homogenous in *P. conchicola*. For all these reasons I am, I believe, authorized to describe the present alga as a new species.

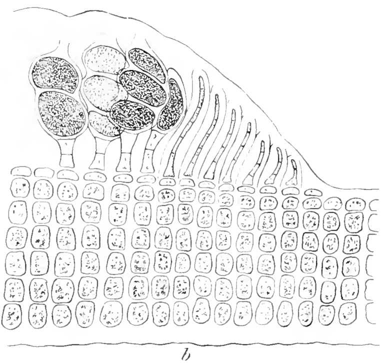

Fig. 148. *Peyssonnelia simulans* nov. spec. Cross section through thallus with nemathecium with carpospores. *b.* basal layer of mucuous substance. (000 : 1).

This species was found at St. Thomas in the sea to the west of Water Island in a depth of about 15 fathoms (No. 1110^{II}), St. Jan off St. Cruz Bay in depths of about 10—15 fathoms (No. 1916, 1752, 1828), off Ram's Head at depth of about 25 fathoms (No. 1943). In alcohol and dry specimens.

6. **Peyssonnelia (Eupeyssonnelia) conchicola** Picc. et Grun.(?)

Piccone et Grunow in Piccone, Algæ eritrea, 1884, p. 317. De Toni, Syll. Alg., vol. IV, sect. IV. 1900, p. 1700.

The algæ from the West-Indies that I call *P. conchicola*, adhere firmly to the substratum and resemble in anatomical character the type specimen from the Red Sea. The West Indian ones carry nemathecia with tetraspores, nemathecia with carpospores I have never seen. *P. conchicola* has been described by Grunow and Piccone after barren specimens; it may therefore

be possible that, if fertile specimens are found, the West-Indian plant will prove to be a different species. I queried it therefore and also, because its colour is darker than the colour of *P. conchicola*. It resembles, as already stated, *P. conchicola* in anatomical structure and differs from *P. simulans*, in adhering firmly to the substratum. From *P. rubra* it is easily known by its long apical cell.

Found at St. Croix, White Bay, in shallow water (No. 1537 I, 1546 I, 1585 I). In alcohol and dry specimens.

Geogr. Distrib.: Red Sea.

7. Peyssonnelia (Eupeyssonnelia) polymorpha? (Zan.) Schm.

Schmitz, in Falkenb., Alg. Neap., 1879, p. 264. De Toni, Syll. Alg., vol. IV, sect. IV, 1905. p. 1701.

Lithymenia polymorpha Zanard., Icon. Phyc. Adriat. I, 1860, p. 127, tab. 30.

The specimen No. 1966 belongs probably to *P. polymorpha*, but it is too small to name it with certainty. It was collected with the dredge and we know that *P. polymorpha* prefers deeper water. Mme Lemoine[1]) has described this alga from various localities in the Mediterranean, and a variety of it has also been found at the island of Amirante[2]) The specimen from St. Thomas has the typical brick-red colour of the species, the hollow crust is entirely loosened from the substratum and the anatomical structure is very much like that of *P. polymorpha*. The specimen bore nemathecia with unripe carpospores.

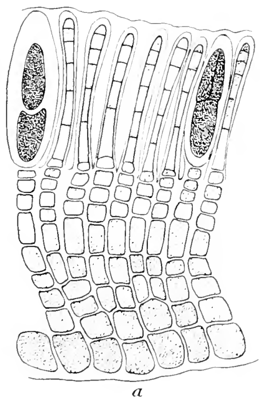

Fig. 149. *Peyssonnelia conchicola* Picc. et Grun. Cross-section through nemathecia with tetraspores. (260 : 1).

Found at St. Thomas near the West-End of the island off Thatch Bay in a depth of about 14–16 fathoms (No. 1966). Dry specimen (by Dr. Th. Mortensen).

Geogr. Distrib.: Mediterranean Sea.

1) Mme P. Lemoine et M. Mouret, Sur une algue nouvelle pour la France. Bull. Soc. Bot. 1912, p. 356.

2) A. Weber-van Bosse, Rhodophyceæ of the "Sealark" Exp. Trans. Linn. Soc. 1913, p. 139.

8. **Peyssonnelia (Eupeyssonnelia) rubra** (Grev.) J. Ag.

J. AGARDH, Spec. Alg. II, 1851, p. 502, Epicr. Flor. 1876, p. 386. DE TONI, Syll. Alg. vol. IV, sect. IV, 1905, p. 1696.

Zonaria rubra, GREVILLE in Linnean Transact. XV, prt. 2, p. 340.

After some hesitation I have named two specimens in Dr. BORGESEN's collection as *P. rubra*, though SCHMITZ[1]) doubted of the occurrence of *P. rubra* in a tropical sea and though, according to J. AGARDH, *P. rubra* should be limited to the Mediterranean. J. AGARDH describes the frond of *P. rubra* as "membranacea" but the carbonate of lime incrustated between the rhizoids and in the basal mucuous layer makes the plant very brittle and calcareous. I could detect no difference between specimens from Naples, Genoa, Antibes and those from the West Indies. The latter are perhaps a little more delicate and orbicular, not so profoundly lobed as the Mediterranean species can be.

Found at St. Croix, White Bay, shallow water, (No. 1546^{II}, 1585^{II}). Dry specimens.

Another specimen (No. 2034) found at St. Jan, off America Hill in a depth of about 15 fathoms, is distinguished by its light, pink colour and thin thallus from *P. rubra*. Its ascending filaments, seen in longitudinal direction, run more obliquely and the first cell of the perithallus is higher than is usually the case in *P. rubra*. This alga stands between *P. rubra* J. Ag. and *P. Gunniana* J. Ag. I hope that future explorers of the West-Indian region, with more material at their disposition, will shed further light on the systematic position of these confusing membranaceous species and will settle my doubts about *P. simulans*, whether it is a new species or to be sunk in *P. conchicola*. I felt, while working out this collection, that to know the limits of a species, one must first distinguish, in order to be able to unite afterwards and that for the present I could only distinguish and had no right to unite.

Fam. 4. ***Hildenbrandiaceæ.***

Hildenbrandia[2]) Nardo.

1. **Hildenbrandia prototypus** Nardo.

NARDO, I., in Isis, 1834, p. 675 (*Hildbrandtia*). HAUCK, F., Meeresalgen, p. 38.

[1]) SCHMITZ, Marine Florideen von Deutsch Ost-Afrika, ENGLER's bot. Jahrb., 1895, p. 172.

[2]) Regarding the spelling of the generic name compare the foot note in ENGLER u. PRANTL., »Die Natürl. Pflanzenfamilien«, I. Teil, Abt. 2, p. 544.

Hildenbrandia Nardi Zanardini, Synopsis Algarum in Mari Adriatico hucusque collectarum (Acad. Re delle Sc. di Torino, Cl. mat. e fis., 2 ser., t. IV, p. 238, tab. 1, fig. 1). J. AGARDH, Spec. Alg., II, p. 494, III, p. 379.

Hildenbrandtia sanguinea Kütz., Phycologia generalis, 1843, p. 384, tab. 78, V.

This alga has been found in shallow water near the shore covering stones and pieces of rocks.

I have compared my plants with European specimens from various places and they seem to agree quite well with these. The cells in the vertical rows of cells in the thallus are about 4—5 μ broad. HAUCK l. c. says that they are 4 μ.

The irregularly shaped tetrasporangia are cruciately divided but often the walls are placed rather anomalously. The tetrasporangia are about 25 μ long and 13 μ broad.

This plant occurred in more sheltered places. As I previously have mentioned[1]) its thin purple-reddish crusts were found upon stones in a lagoon at St. Croix growing in the shade of the mangrove trees; at St. Jan it was growing upon small round stones in a more open place.

St. Croix: Saltriver Lagoon. St. Jan: Cruz Bay.

Geogr. Distrib.: Jamaica, Brazil, Atlantic Ocean, Mediterranean Sea, Pacific Ocean etc. most probably ubiquitous.

Fam. 5. Corallinaceæ.

Subfam. 1. Melobesieæ.

Par Mme PAUL LEMOINE.

L'importante collection de Mélobésiées recueillie par M. BOERGESEN au cours de ses voyages aux Antilles Danoises avait été confiée à M. FOSLIE, de Trondhjem, que la mort a surpris (1909) avant qu'il ait pu terminer son travail. Il restait à déterminer un certain nombre d'échantillons; M. BOERGESEN a eu l'amabilité de m'en proposer l'étude. Quelques-unes des espèces déterminées par M. FOSLIE étaient nouvelles; au fur et à mesure de ses déterminations il les avait décrites dans ses »Algologiske notiser«, mais sans les figurer. Aussi ai-je repris l'étude de toutes ces espèces[2]) de manière à pouvoir donner ici un mémoire d'ensemble

[1]) BØRGESEN, F., The algal vegetation of the lagoons in the Danish West Indies. Biologiske Arbejder tilegnede EUG. WARMING. Kobenhavn 1911.

[2]) Ce travail a été fait au Laboratoire de Cryptogamie du Muséum d'Histoire naturelle de Paris (Professeur MANGIN, membre de l'Institut).

comprenant la description et la figuration de toutes les espèces recueillies.

Les algues ont été récoltées par M. Boergesen à St Jan, St. Thomas et Ste Croix soit par draguage jusqu'à des profondeurs de 30 à 40 mètres, soit à marée basse sur les cailloux, sur d'autres algues, et sur les récifs de polypiers où les Mélobésiées abondent et vivent en compagnie des Bryozoaires. D'après la quantité considérable de matériaux recueillis il est peu probable que l'on trouve à l'avenir, dans ces îles, de nouvelles espèces, tout au moins d'espèces jouant un rôle important dans la flore.

La flore des Mélobésiées des Antilles Danoises se compose de 20 espèces et représente une grande partie du nombre total des espèces recueillies jusqu'ici dans l'ensemble des îles des Antilles (environ 32 espèces).

Voici la liste des espèces recueillies par M. Boergesen:

Lithothamnium mesomorphum Fosl., var. *ornatum* Fosl. et Howe: St. Jan.
— *sejunctum* Fosl.: St. Croix, St. Thomas.
— *ruptile* Fosl.: St. Jan, St. Croix, St. Thomas.
— *occidentale* Fosl.: St. Jan, St. Thomas, St. Croix.
Lithophyllum accretum Fosl. et Howe: St. Croix.
— *caribaeum* Fosl.: St. Jan, St. Croix, St. Thomas.
— *erosum* Fosl.: St. Thomas.
— *intermedium* Fosl.: St. Jan.
— *daedaleum* Fosl. et Howe: St. Croix.
— *strictum* (Fosl.) Lemoine: St. Croix.
— (?) *absimile* Fosl. et Howe: St. Jan, St. Croix.
— (?) *propinquum* (Fosl.) Lemoine: St. Jan, St. Croix, St. Thomas.
— *(Dermatolithon) prototypum* Fosl.: St. Jan, St. Croix.
Melobesia farinosa Lamx.: St. Jan, St. Croix, St. Thomas
var. *Solmsiana* Falkb.: St. Jan, St. Croix, St. Thomas.
— *(Lithoporella) atlantica* (Fosl.) Lemoine: St. Jan.
— *(Litholepis) affinis* (Fosl.) Lemoine: St. Jan, St. Croix.
— *(Pliostroma) Chamaedoris* Fosl. et Howe: St. Jan, St. Croix.
Porolithon mamillare (Harv.) Lemoine, var. *occidentalis* Fosl.: St. Jan, St. Croix. St. Thomas.
— *Boergesenii* (Fosl.) Lemoine: St. Croix.
— *pachydermum* Fosl.: St. Jan.

On voit dans le tableau précédent que le genre *Lithothamnium* est représenté par 4 espèces, le genre *Lithophyllum* par 9, le genre *Melobesia* par 4 et le genre *Porolithon* par 3. Il y a une prédominance très nette d'espèces en croûtes car deux espèces seulement sont des espèces ramifiées, et l'une d'elles, *L. strictum* est représentée par une variété naine, non ramifiée.

Au point de vue de la structure, les espèces crustacées montrent pour la plupart un caractère intéressant: c'est la

réduction de l'hypothalle. Je rappellerai que ce caractère se présente indifféremment chez certaines espèces de chacun des genres *Lithothamnium*, *Lithophyllum*, *Porolithon*. Alors qu'il paraît rare dans les espèces des régions européennes, ici on l'observe dans 4 espèces de *Lithophyllum* et 2 espèces de *Porolithon*.

J'ai cherché à tracer aussi exactement que possible la répartition et les affinités des espèces des Antilles Danoises. Il n'y a que trois espèces qui soient connues à la fois dans les Antilles Danoises et dans les mers européennes et africaines.

Melobesia farinosa paraît être ubiquiste; les deux autres espèces vivraient sur la côte atlantique africaine: *Porolithon mamillare* au Cap Vert, à St. Vincent et à Algoa Bay d'après Harvey; *Porolithon Boergesenii* à San Thomé dans le Golfe de Guinée, où d'après Foslie, il serait représenté par sa variété *africana*. Je n'apporte, pour ma part, aucune contribution à ces faits. L'échantillon de la collection du Museum d'Histoire naturelle de Paris qui a servi à créer la var. *africana* de *P. Boergesenii* est de si petite dimension que ce serait le détruire que de l'étudier; je ne sais si Foslie a eu en mains un échantillon plus important.

En admettant que 3 espèces des Antilles ont une répartition assez étendue, il reste 17 espèces qui sont limitées à la région atlantique américaine: 12 espèces vivent soit en Floride, soit aux Bahamas en même temps qu'aux Antilles Danoises; les autres espèces, au nombre de 5, n'ont pas jusqu'ici été recueillies en dehors des Antilles; enfin 3 espèces de petite taille ne sont connues qu'aux Antilles Danoises.

Ainsi il y a peu d'espèces communes aux Antilles et à la région africano-européenne. Mais, d'autre part on ne peut pas ne pas être frappé d'une ressemblance extérieure très grande entre certaines espèces des Antilles et d'autres espèces appartenant au même genre et vivant dans la Méditerranée: ce fait est si net que, pour la plupart des espèces, il est possible de mettre en regard de l'espèce des Antilles une espèce méditerranéenne d'aspect quelquefois si semblable qu'on pourrait les confondre: ce sont ces ressemblances que j'ai groupées dans le tableau suivant.

Antilles:	**Méditerranée:**
Lithothamnium mesomorphum var. *ornatum*.	*Lithothamnium lichenoides*.
— *sejunctum*.	— *Lenormandi*.
— *ruptile*.	— *crispatum*.
— *occidentale*.	— *fruticulosum* var. *clavulata*.

Lithophyllum intermedium.	*Lithophyllum incrustans.*
— *daedaleum.*	— *dentatum.*
— *(?) propinquum.*	— *(?) Notarisii.*
— *(D.) prototypum.*	— *(D.) papillosum.*
Melobesia (Litholepis) affinis.	*Melobesia (Litholepis) Sauvageaui.*

D'autres espèces montrent d'autre part des analogies remarquables avec les espèces de l'Océan Indien et du Pacifique:

Antilles:	**Indo-Pacifique:**
Lithophyllum strictum.	*Lithophyllum frutescens.*
Melobesia (Lithoporella) atlantica.	*Melobesia (Lithoporella) melobesioides.*
Porolithon pachydermum.	*Porolithon oncodes.*
— *Antillarum.* [1])	— *craspedium.*

Pour les espèces *L. accretum*, *L. absimile*, *L. caribaeum*, *L. erosum*, *M. Chamaedoris*, je ne connais pas d'espèces affines.

Cette analogie d'aspect, souvent très frappante, entre les espèces des Antilles Danoises et celles de la Méditerranée ou du Pacifique n'est qu'apparente: la structure offre souvent des caractères très différents. Un cas typique est par exemple celui du *Lithophyllum intermedium*; par son aspect, et les caractères de ses conceptacles, cette espèce ressemble à s'y méprendre à *Lithophyllum incrustans* de la Méditerranée et des côtes européenne et africaine de l'Atlantique; bien plus, les deux espèces paraissent vivre dans les mêmes conditions et forment sur les rochers des encroûtements qui abritent une foule d'animaux; or, le seul examen de la structure éloigne ces deux espèces l'une de l'autre; *L. incrustans* montre un hypothalle épais formé de rangées concentriques, tandis que dans *L. intermedium* l'hypothalle n'est représenté que par une unique rangée de cellules.

Pour d'autres espèces les différences ne seront pas aussi profondes; cependant les dimensions des cellules, l'aspect du tissu, les dimensions des conceptacles sont autant de caractères autorisant l'individualité des espèces des Antilles.

Si j'ai insisté sur ces analogies, ce n'est donc pas pour discuter la valeur des espèces créées jusqu'ici, mais c'est plutôt pour rechercher les relations et les affinités qui existent entre les espèces.

Tableaux de détermination des espèces des Antilles Danoises.

Ainsi qu'il a été dit plus haut les espèces des Antilles Danoises représentent une partie importante du nombre total des espèces connues jusqu'ici dans l'ensemble des Antilles.

[1]) Cette espèce n'a pas été trouvée aux Antilles Danoises.

Les espèces des Antilles inconnues aux Antilles Danoises sont les suivantes:

Lithophyllum acropetum Porto-Rico.
— *affine* Porto-Rico.
— *congestum* St. Barthelemy.
— *platyphyllum* St. Martin.
— *(Dermatolithon) polyclonum.*
Lithothamnium aemulans Porto-Rico.
Archaeolithothamnium dimotum Porto-Rico.
Porolithon improcerum Jamaïque.
— *Antillarum* Porto-Rico.
Mastophora Lamourouxi Guadeloupe.
Epilithon membranaceum Jamaïque, Porto-Rico, Guadeloupe.

D'autres espèces ont été signalées aux Antilles par suite d'erreurs de détermination et il ne doit pas en être tenu compte; les échantillons appelés *Lithophyllum incrustans* (Collins 1901) doivent sans doute être rapportés au *Lithophyllum intermedium*; *Melobesia confervicola* de la Guadeloupe (Mazé et Schramm 1877) est le *Melobesia farinosa* d'après Foslie; le *Melobesia callithamnioides* de la Guadeloupe également (Conquérant in herb. Bornet) est sans doute le *M. farinosa* var. *Solmsiana*; d'autre part Foslie a rangé dans le *Lithothamnium occidentale* var. *effusa* des échantillons appelés tout d'abord par lui *L. solutum* var. *effusa* (Foslie 1906, c); de même les échantillons nommés primitivement *Porolithon oncodes* (Weber et Foslie 1904) ont été ensuite avec raison distingués, sous le nom de *Porolithon pachydermum*, de ceux de l'Océan Pacifique; de même ceux nommés *Lithothamnium Lenormandi* sont devenus *Lithothamnium sejunctum*; enfin c'est certainement par erreur qu'ont été signalés aux Antilles les espèces: *Lithothamnium polymorphum* et *L. amplexifrons* (Mazé et Schramm 1877); il semble également que le *Melobesia Lejolisii* (Collins 1901) n'atteigne pas la latitude des Antilles; certains échantillons de *M. farinosa* dépourvus d'hétérocystes sont difficiles à distinguer de *M. Lejolisii.* Quant au *Lithophyllum* (*Derm.*) *pustulatum* (Collins 1901) il serait possible que les échantillons dussent être rangés plutôt dans la var. *Udoteae* du *Lith.* (*D.*) *prototypum*; les deux espèces sont difficiles à séparer lorsqu'il s'agit de petits échantillons sur algues.

I. Conceptacles à sporanges ayant leur toit percé d'un certain nombre de canaux.
† Tissu différencié en hypothalle et périthalle; hypothalle formé de files horizontales de cellules .... *Lithothamnium.*

II. Conceptacles à sporanges ayant leur toit percé d'un seul pore.
† Tissu différencié en hypothalle (souvent réduit à une seule rangée de cellules) et en périthalle.
×× Tissu composé entièrement ou seulement en partie de rangées de cellules séparées les unes des autres par les cloisons tangentielles épaissies et plus ou moins soudées les unes aux autres . . . . *Lithophyllum.*
×× Tissu généralement irrégulier souvent formé de cellules de formes et de dimensions variées; présence de grosses cellules soit isolées soit en groupes de 5 à 8 . . . . *Porolithon.*
† Tissu non différencié en hypothalle et périthalle; croûtes très minces formées d'une ou plusieurs rangées superposées . . . *Melobesia.*

Genre Lithothamnium.

I. Espèces en croûtes.
Croûte très adhérente, lobée et striée au bord, très mince, sur pierres.
Hypothalle: cellules rectangulaires 10 à 15 $\mu \times$ 3 à 7 μ; périthalle: cellules ovoides 5 à 7 $\mu \times$ 3 à 7 μ. Conceptacles à sporanges 160 à 260 μ; 40 canaux dans le toit; conceptacles à cystocarpes 200 à 300 μ . . . . *L. sejunctum* Fosl.
Croûte peu adhérente formant souvent des lamelles libres orbiculaires, minces et fragiles, brillantes. Tissu lâche; hypothalle: cellules rectangulaires: 10 à 14 jusqu'à 25 $\mu \times$ 4 à 7 μ; périthalle: cellules arrondies de 10 à 12 $\mu \times$ 7 à 10 μ à la base, 5 à 8 $\mu \times$ 5 à 7 μ au sommet. — Stérile . . . .
L. mesomorphum Fosl. var. *ornatum* Fosl. et Howe.
Croûtes peu adhérentes, minces, irrégulières, d'aspect variable. Tissu lâche; hypothalle: files entremêlées, cellules rect.-ovoides 20 à 30 $\mu \times$ 7 à 10 μ; périthalle: cellules ovoides de 10 à 15 $\mu \times$ 7 à 10 μ. Conceptacles à sporanges 500 à 700 μ . . . . *L. ruptile* Fosl.

II. Espèce en branches.
Tissu formé de files lâches distinctes; cellules rectangulaires-ovoides 10 à 30 $\mu \times$ 6 à 10 μ. Souvent stérile . . . . *L. occidentale* Fosl.

Genre Lithophyllum.

I. Espèces en croûtes.
† Hypothalle formé d'une seule rangée de cellules.
× Croûtes très minces.
Surface rugueuse; hypothalle: cellules 5 à 7 $\mu \times$ 5 à 12 μ; périthalle tissu compact, cellules rectangulaires 3 à 6 $\mu \times$ 3 à 8 μ. Conceptacles en petits granules convexes de 80 à 120 μ; à maturité petites cavités . . . . *L. caribaeum* Fosl.
Cellules en files distinctes à la base, plus serrées à la partie supérieure, 5 à 7 $\mu \times$ 7 μ. Conceptacles de forme ovale; partie centrale du toit déprimée entouré par un rebord ovale . . . . . .
L. erosum Fosl.
× Croûtes épaisses mamelonnées ou pourvues d'excroissances. Périthalle primaire: files cellulaires distinctes; cellules rectangulaires de 7 à 20 $\mu \times$ 5 à 8 μ, disposées au même niveau.

Périthalle secondaire: files serrées; cellules de 10 à 22 $\mu \times 5$ à 12 μ, en rangées. Ecorce: cellules 5 $\mu \times 10$ μ. Conceptacles convexes de 250 à 380 μ; sporanges 60 $\mu \times 30$ à 55 μ. Conceptacles à cystocarpes convexes-coniques 200 à 350 μ .... *L. dædaleum* Fosl. et Howe.

Hypothalle: cellules 10 à 12 $\mu \times 4$ μ. Perithalle: cellules de 8 à 15 μ jusqu'à 20 $\mu \times 5$ à 7 μ, en rangées à la base, en files distinctes à la partie supérieure. Conceptacles 150 à 300 μ de diamètre formant de petites dépressions à la surface du thalle .... *L. intermedium* Fosl.

† Hypothalle formé de rangées concentriques.

Hypothalle: cellules 7 à 12 $\mu \times 5$ à 10 μ. Périthalle: cellules de 5 à 12 $\mu \times 5$ à 15 μ, au même niveau souvent en rangées; parois des cellules très épaisses. Conceptacles 300 à 400 μ, de forme ovale, avec la partie centrale du toit déprimée .. .... *L. accretum* Fosl. et Howe.

† Hypothalle formé de files cellulaires non disposées en rangées (structure aberrante dans le genre Lithophyllum).

Croûte adhérente, lobée, à surface irrégulière.

Hypothalle épais; cellules de 10 à 12 $\mu \times 6$ à 9 μ, plus rarement jusqu'à 18 et 22 μ. Périthalle très épais, cellules de 3 à 7 $\mu \times 2$ à 3 μ en files distinctes; périthalle traversé par des lignes colorées. Conceptacles très serrés, convexes, de 100 à 160 μ de diamètre..................... *L. absimile* Fosl. et Howe.

Croûte peu adhérente, mince, lobée, quelquefois pourvue de lamelles.

Hypothalle files serrées rigides, cellules rectangulaires 15 à 35 $\mu \times 7$ à 12 μ; périthalle: cellules rectang. en rangées: 7 à 11 $\mu \times 5$ à 12 μ. Conceptacles très gros, coniques, de 300 à 1200 μ, quelquefois prolongés par des épines. Sporanges 90 à 160 $\mu \times 40$ à 60 μ .... *L. propinquum* Fosl.

II. Espèce en branche.

Croûte mince, lobée surmontée de nombreuses petites branches cylindriques non ramifiées de 4 mm de hauteur et 1 mm de diamètre. Tissu formé de rangées; cellules rectangulaires 12 à 20 $\mu \times 7$ à 15 μ...... *L. strictum Fosl. var. nana* Fosl. et Howe.

Sous-Genre Dermatolithon.

Périthalle formé entièrement de hautes cellules rectangulaires pourvues de pores, disposées en rangées. Hypothalle formé de cellules obliques, contournées, de grande taille.

Croûtes très adhérentes recouvertes d'un grand nombre de très petites lamelles. Tissu composé de 6 à 12 rangées qui se séparent les unes des autres; cellules de 7 à 35 $\mu \times 10$ à 15 μ; chaque rangée est recouverte d'une rangée de petites cellules corticales de 3 à 5 μ; hypothalle peu différencié; cellules de 40 à 80 μ. Conceptacles à sporanges hémisphériques de 350 à 600 μ; sporanges: 60 à 80 $\mu \times 35$ à 50 μ. C. à cystocarpes coniques, 450 à 550 μ............. *L. (D.) prototypum* Fosl.

Genre Melobesia.

Croûtes sur algues, d'abord circulaires formant ensuite des croûtes plus étendues, très minces. Thalle constitué en coupe par 3 rangées de cellules. Vu de dessus tissu caractérisé par des hétérocystes. Conceptacles de 60 à 250 μ . . . . *M. farinosa* Lmx.

Sous-Genre Litholepis.

Croûtes saxicoles, très fines, semblables à une poussière puis formant des thalles circulaires; thalle formé d'une seule rangée de cellules. Croûtes poussant les unes au-dessus des autres. Conceptacles petits.

Cellules de 14 à 22 $\mu \times$ 9 à 18 μ. Conceptacles de 60 à 260 μ. *M. (L.) affinis* (Fosl.) Lem.

Sous-Genre Lithoporella.

Croûtes minces, sur coraux, poussant les unes au-dessus des autres. Thalle formé d'une ou deux rangées de cellules. Conceptacles très gros, coniques.

Cellules de 18 à 32 $\mu \times$ 10 à 25 μ quelquefois atteignant 60 μ $\times$ 40 μ. Conceptacles à sporanges de 500 à 800 μ . . . . *M. (L.) atlantica* (Fosl.) Lem.

Sous-Genre Pliostroma.

Croûtes très minces sur algues et pierres, constituées par plusieurs rangées de cellules, sauf à la marge qui n'est formée que d'une seule rangée. Conceptacles petits, convexes.

Cellules de 7 à 13 $\times$ 8 à 10 μ. Conceptacles de 150 à 200 μ. *M. (P.) Chamædoris* Fosl. et Howe.

Genre Porolithon.

Hypothalle formé d'une rangée de cellules.

Croûte épaisse. Hypothalle: cellules 20 à 25 $\mu \times$ 8 μ. Périthalle: tissu irrégulier, cellules de 7 à 18 $\mu \times$ 8 à 12 μ; grosses cellules isolées de 20 à 25 $\mu \times$ 18 à 20 μ. Conceptacles à sporanges: 300 à 400 μ . . . . *P. Boergeseni* Fosl.

Croûte mince, lobée, peu adhérente, pourvue de nombreuses épines et de lamelles. Cellules de l'hypothalle peu différenciées; périthalle cellules 10 à 20 $\mu \times$ 7 à 15 μ; parois des cellules minces. Conceptacles très gros coniques de 1 mm, 4 . . . . *P. mamillare* Harv.

Hypothalle formé de files horizontales de cellules.

Croûte adhérente sur coraux. Hypothalle formé de quelques files; cellules de 8 à 17 $\mu \times$ 4 à 10 μ. Périthalle tissu compact, cellules 4 à 8 $\mu \times$ 7 à 12 μ. Grosses cellules en groupe de 8, de 17 à 20 $\mu \times$ 8 à 15 μ. Conceptacles à sporanges convexes 150 à 250 μ de diamètre; sporanges de 60 à 70 $\mu \times$ 30 à 40 μ. Conc. à cystocarpes convexes de 200 à 300 μ. *P. pachydermum* Fosl.

Lithothamnium Phil.

1. **Lithothamnium mesomorphum** Foslie.

1901. *Lithothamnium mesomorphum* Foslie, New. Melob., p. 5.
1906. *Lith. mesomorphum ornatum* Foslie et Howe, New. Amer. Corall. alg., p. 129, pl. 80, fig. 2, pl. 90, fig. 2.

Lithothamnium mesomorphum est représenté dans la collection de M. Boergesen par quelques échantillons appartenant à la variété *ornatum*; ils forment de petites lamelles fragiles, de forme d'abord circulaire puis ensuite orbiculaire, fixées seulement par un point de la face inférieure ou par une extrémité; la marge est blanche et légèrement épaissie. Cette espèce peut également se présenter sous l'aspect de croûtes qui montrent, comme les lamelles, une surface brillante; ces croûtes se détachent facilement des coraux sur lesquels elles sont fixées et elles ont une tendance marquée à la formation ça et là de petites lamelles orbiculaires dressées.

Par son aspect brillant, sa surface striée et ses gros conceptacles *L. mesomorphum* rappelle beaucoup l'espèce atlantique et mediterranéenne *L. lichenoides*; la var. *ornatum* a aussi une certaine ressemblance avec *L. expansum* de la Méditerranée, en particulier avec sa var. *tenuis*.

L. mesomorphum var. *ornatum* est généralement stérile; dans la forme type les conceptacles à sporanges ont de 350 à 600 μ de diamètre, de forme peu définie; leur toit est percé de nombreux canaux; les sporanges mesurent 100 à 140 μ de longueur et 60 μ de largeur.

En coupe *L. mesomorphum* montre une structure très lâche avec de larges interstices entre les files de cellules; l'hypothalle est formé de cellules rectangulaires; de 10 à 14 μ de longueur et 4 à 7 μ de largeur, et même de 20 à 25 $\mu \times$ 4 à 7 μ; il est peu développé, formé seulement de quelques files. Les cellules du périthalle qui lui font suite sont arrondies, elles mesurent 10 à 12 $\mu \times$ 7 à 10 μ près de l'hypothalle et vont en diminuant de taille vers la partie supérieure de la croûte où elles ne mesurent que 5 à 8 $\mu \times$ 5 à 7 μ. L'épaisseur des croûtes est de 300 à 500 μ.

St. Jan: Entre Cruz Bay et Great St. James, No. 2143, profondeur 15 brasses; au large d'Annaberg, No. 1989, prof. 15 brasses $^{1}/_{2}$.

Répartition géographique: *L. mesomorphum* a été signalé aux Iles Bermudes (Herbier Bornet, échantillons récoltés par le Général Lefroy en 1873 et par M. Farlow en 1881); Howe l'a recueillie aux Iles Bahamas. Il n'avait pas encore été signalé aux Antilles; il n'est d'ailleurs représenté que par quelques échantillons recueillis à une certaine profondeur; il paraît

donc rare aux Antilles Danoises. C'est une espèce à rechercher, à cause de sa fragilité, dans les endroits abrités et les anfractuosités des rochers et des récifs.

2. **Lithothamnium sejunctum** Foslie.

1906. *Lithothamnium sejunctum* Foslie, Alg. Not. II, p. 13.

L. sejunctum forme, sur les pierres, de petites croûtes adhérentes très minces, lobées au bord et liserées de blanc sur les échantillons secs; l'aspect est assez voisin de celui de *L. Lenormandi* commun sur les côtes européennes de l'Atlantique, en particulier de sa variété *sublævis.*

Les conceptacles à sporanges mesurent 160 à 260 μ de diamètre; leur toit est percé de 40 canaux. Les conceptacles à cystocarpes mesurent 200 à 300 μ.

En coupe verticale on observe la présence de l'hypothalle et du périthalle. L'hypothalle est formé de quelques files de cellules; les cellules sont rectangulaires, légèrement ovoides, de 10 à 15 μ de longueur et 3 à 7 μ de largeur. Les cellules du périthalle sont ovoides, de 5 à 7 μ de longueur et 3 à 7 μ de largeur.

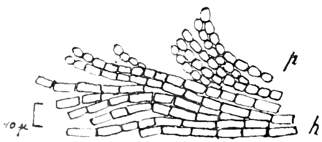

Fig. 150. Coupe verticale d'une croûte de *Lithothamnium sejunctum.*

L'analogie d'aspect extérieur entre *L. sejunctum* et *L. Lenormandi* n'est pas accompagnée d'une analogie complète dans la structure; en effet les cellules de l'hypothalle de *L. Lenormandi* mesurent 15 à 22 $\mu \times$ 3 à 4 μ; elles sont rectangulaires à angles vifs; les cellules du périthalle sont rectangulaires-ovoides et mesurent 6 à 9 $\mu \times$ 4 à 5 μ; les conceptacles à sporanges et à cystocarpes sont un peu plus grands et mesurent 200 à 400 μ; enfin le toit du conceptacle est dissous dans sa partie centrale et il reste une bordure annulaire caractéristique.

St. Croix: Christiansted. St. Thomas côte Nord.

Répartition géographique. Cette petite espèce n'a pas jusqu'ici été recueillie en d'autres localités.

3. **Lithothamnium ruptile** Foslie.

1905. *Lithothamnium syntrophicum* Fosl. f. *ruptilis* Fosl.; Foslie, Botan. Saml. (1904) 1905, p. 18.

1907. *Lithothamnium ruptile* Foslie, Alg. Not. III, p. 5.

Lithothamnium ruptile se présente sous l'aspect de croûtes minces, irrégulières, souvent contournées, poussant les unes au-

dessus des autres et formant ainsi une croûte complexe qui se libère de son substratum; la croûte peut s'enrouler sur elle-même en certains points de manière à simuler des sortes de petites coupes évasées ou des sortes de branches creuses. L'aspect est en somme assez variable, mais les croûtes se distinguent de la plupart des autres espèces des Antilles parce qu'elles ne sont pas adhérentes au substratum. Cette espèce rappelle beaucoup, *Lithothamnium crispatum* de la Méditerranée et *L. syntrophicum.*

Les conceptacles à sporanges sont de grande taille et mesurent 500 à 700 μ de diamètre. En coupe on observe que l'hypothalle est formé d'un certain nombre de files lâches et entremêlées ; les cellules sont rectangulaires-ovoides et mesurent 20 à 30 μ de longueur et 7 à 10 μ de largeur. Lorsqu'il y a formation d'une excroissance l'hypothalle y contribue en formant des files verticales dont les cellules sont rectangulaires et mesurent 25 à 30 $\mu \times$ 9 à 14 μ; l'hypothalle est continué par le périthalle dont les cellules ovoides et gonflées en forme de ballon mesurent 10 à 15 μ de longueur et 7 à 10 μ de largeur.

Fig. 151. Croûte de *Lithothamnium ruptile* (grandeur naturelle).

St. Thomas: Thatch Cay, No. 1967; St. Jan: Au large de Cruz Bay, No. 1826, 2142. St. Croix: White Bay, No. 1590.

Répartition géographique. Cette espèce a été signalée à St. Domingue; peut-être est-ce la même espèce qui aurait été signalée aux Bermudes sous le nom de *L. syntrophicum* (Foslie 1901).

4. Lithothamnium occidentale Foslie.

1906. *Lithothamnium fruticulosum* (Kütz.) Fosl., var. *occidentale* Foslie, Alg. Not., II, p. 12

1908. *Lithothamnium occidentale* Foslie, Nye Kalkalg., p. 3 (f. *effusa* Fosl.).

Cette espèce constitue de petits massifs formés de branches ramifiées souvent coalescentes; l'aspect en est souvent informe et peu élégant; il est probable que cet aspect résulte de conditions de vie nuisibles à l'espèce, car les branches sont quelquefois creuses en leur partie centrale et l'espèce est souvent stérile. Des échantillons mieux développés, formés de branches fines et divergentes ont été groupés par M. Foslie dans la variété *effusa.*

En coupe le tissu est composé de files cellulaires lâches, séparées les unes des autres; les cellules sont rectangulaires, légère-

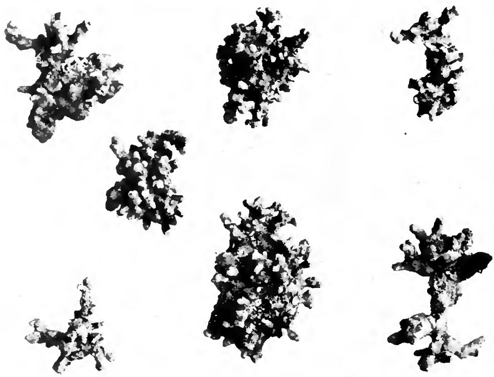

Fig. 152. Thalles de *Lithothamnium occidentale* (grandeur naturelle).

ment gonflées, elles mesurent 10 à 20 μ, jusqu'à 32 μ de longueur et 6 à 10 μ de largeur; elles sont en somme de taille très variable; les cloisons ne se colorent pas fortement par les réactifs.

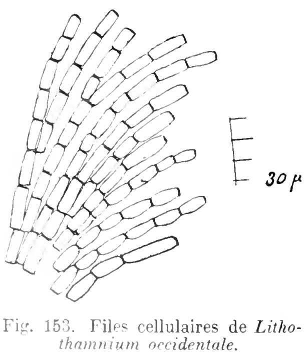

Fig. 153. Files cellulaires de *Lithothamnium occidentale*.

L'espèce a montré jusqu'ici des conceptacles jeunes ou mal développés; cependant dans une coupe j'ai observé une tétraspore qui mesurait 180 μ de longueur et 75 μ de largeur.

St. Jan: Au large d'Annaberg No. 1989, profondeur 15 brasses; au large d'America Hill, No. 2072, 2003; au large de Cruz Bay No. 1826, 1917, 1727, 2221. Entre St. Jan et St. Thomas, (Dr. Th. Mortensen); entre St. Jan et Thatch Island No. 1995. St. Thomas: Ouest de Water Island, No. 1178, profondeur 20 brasses. St. Croix: White Bay, No. 1590.

Répartition géographique. Cette espèce a été signalée à St. Domingue. Aux Antilles Danoises il faut noter son abondance à St. Jan et sa faible abondance a St. Croix.

Lithophyllum Phil.

1. **Lithophyllum accretum** (Fosl. et Howe) Lem.

1906. *Goniolithon accretum* Fosl. et Howe, New Amer. Corall. Alg., p. 131, pl. 85, fig. 2, pl. 91.

Cette espèce se présente sous l'aspect de croûtes circulaires qui se réunissent en formant des croûtes d'une certaine étendue, adhérant très fermement au substratum; l'epaisseur est généralement de 80 à 350 μ; elle peut atteindre 1 mm. 3; elles sont lobées au bord, et striées; la marge est un peu plus épaisse; à la limite de deux thalles, il y a formation d'un rebord. Cette espèce recouvre *L. caribaeum* et est à son tour recouverte par *L. intermedium* et *L. propinquum.*

La surface est couverte de conceptacles jusqu'à la marge; les conceptacles à sporanges sont convexes, peu saillants; la partie centrale du toit s'affaisse légèrement et est entouré par un rebord; les conceptacles à cystocarpes sont légèrement coniques et à maturité laissent à leur place un trou; le diamètre des conceptacles est de 300 à 400 μ.

En coupe *L. accretum* montre un hypothalle composé de cellules de 7 à 12 $\mu \times$ 5 à 10 μ, disposées à peu près régulièrement en rangées concentriques; les cloisons séparant les rangées sont plus ou moins épaissies, en certains points elles atteignent 5 μ. Dans les croûtes minces, l'hypothalle occupe presque toute l'épaisseur de la croûte; dans des croûtes plus épaisses, on observe le périthalle formé de cellules très larges de 5 à 12 μ de longueur et 5 à 15 μ de largeur, les membranes des cellules sont très épaisses; les cellules sont disposées au même niveau et en certains points forment des rangées.

En dehors des échantillons de Boergesen, j'ai étudié ceux de Howe provenant des Bahamas; on remarquera que ma description basée sur l'étude de ces échantillons diffère de celle donnée par Foslie et Howe: ces auteurs ont donné pour les cellules de l'hypothalle les dimensions 14 à 27 $\mu \times$ 8 à 14 μ, et pour celles du périthalle 4 à 9 μ. D'ailleurs la figure qu'ils ont donnée pl. 91 ne ressemble pas à la coupe que j'ai obtenue en étudiant l'échantillon de Howe des Bahamas; cette figure rappellerait plutôt la structure de *Lithophyllum absimile.*

St. Croix: Sur caillou dans l'eau peu profonde.

Répartition géographique. *L. accretum* a été signalé en Floride: Sands Key; aux Bahamas; aux Antilles il n'avait encore été signalé qu'avec doute à Porto-Rico.

2. Lithophyllum (?) caribaeum Fosl.

1906. *Lithophyllum decipiens* Fosl., *f. caribaea* Fosl., Alg. Not. II, p. 18.
1907. — *caribaeum* Fosl., Alg. Not. III, p. 22.
1909. — — Fosl., Alg. Not. VI, p. 11.

Cette espèce forme, sur les pierres, des croûtes très minces dont la surface, sauf sur les pierres schisteuses, est légèrement rugueuse; au début les croûtes se développent en grand nombre et ne recouvrent pas complètement le substratum; puis elles se réunissent et forment des croûtes étendues qui sont très souvent cachées en partie par des espèces dont les thalles sont plus épais comme *L. propinquum* et *L. intermedium* (fig. 159) et *L. accretum*. Les conceptacles forment de petits granules souvent si nombreux qu'ils couvrent toute la surface; leur diamètre est de 80 à 120 μ; à maturité ils laissent à leur place de petites cavités.

La structure de cette espèce à pour caractère principal la réduction de l'hypothalle formé d'une seule rangée de cellules rectangulaires de 4 à 7 μ de hauteur et 5 à 12 μ de largeur.

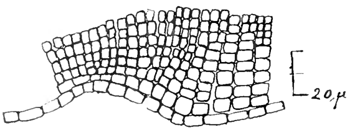

Fig. 154. Coupe verticale du thalle de *Lithophyllum caribaeum*.

Le périthalle forme un tissu très compact; les files cellulaires sont très serrées; les cellules sont très petites rectangulaires de 3 à 6 μ de longueur et 3 à 8 μ de largeur. Dans les échantillons étudiés le tissu ne montrait pas une disposition en rangées très nette: aussi cette espèce doit-elle être placée parmi les espèces aberrantes du genre.

St. Croix: Port de Christiansted, dans l'eau peu profonde. Estate Northside, sur les roches exposées, No. 1468. St. Jan: Cruz Bay, No. 2196; Great Cruz Bay, No. 1782, 1783. St. Thomas: Près de Water Island, profondeur 15 brasses, No. 1161.

Répartition géographique. *L. caribaeum* paraît être une des espèces caractéristiques des Antilles et des Bahamas. Aux Antilles, en dehors des localités indiquées, elle a été recueillie à Porto-Rico par Howe.

3. Lithophyllum erosum Fosl.

1906. *Lithophyllum erosum* Foslie, Alg. Not. II, 1906, p. 20.

L. erosum forme sur les cailloux des croûtes très minces (en coupe 40 μ environ) qui suivent la forme et les aspérités du substratum; le contour est très découpé.

Les conceptacles sont petits, peu proéminents, souvent de forme ovale; puis le toit est déprimé dans la partie centrale et

enfin l'aspect est celui d'une petite cavité ovale entourée par un rebord ; en dernier lieu le rebord lui-même a disparu. En coupe l'un d'eux mesurait 80 μ de large et 40 μ de haut.

Le tissu est composé de petites cellules rectangulaires de 5 à 7 μ et 10 μ de longueur et 7 μ de largeur, fortement colorées par les réactifs, disposées en files distinctes à la base et plus serrées à la partie supérieure. L'hypothalle est représenté par la rangée basilaire de cellules. Je n'ai pas observé de rangées dans le tissu qui par conséquent, de même que *L. caribaeum*, doit être placé à part dans le genre *Lithophyllum*.

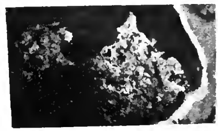

Fig. 155. Thalles de *Lithophyllum erosum*.

St. Thomas: Près de la côte, dans Magens Bay.

Répartition géographique. *L. erosum* n'a pas encore été signalé en d'autres localités.

4. Lithophyllum intermedium Fosl.

1901. *Goniolithon? (Cladolithon) intermedium* Foslie, New Melob., p. 15.
1906. *Lithophyllum intermedium* Foslie, Alg. Not. II, p. 23.

L. intermedium forme à l'état jeune, de petits thalles de forme circulaire, lobés ou crénelés aux bords, qui recouvrent d'autres croûtes plus minces comme *L. caribaeum* et *L. propinquum*, ainsi qu'on le voit fig. 161. A un stade plus développé, le thalle s'agrandit, la surface devient mamelonnée (Fig. 156) et lorsque plusieurs thalles, développés sur le même substratum viennent à se rencontrer, leur bord se relève en formant une crête dressée, ondulée.

Fig. 156. Croûte de *Lithophyllum intermedium* (marquée d'une croix).

L'aspect de l'algue, soit jeune, soit plus âgée lorsque sa surface est mamelonnée, rappelle celui de *Lithophyllum incrustans* et de *Pseudolithophyllum discoideum*; ces trois espèces si différentes de structure ont un aspect presque semblable; toutes trois vivent dans la zone littorale, sur les rochers accessibles à marée basse.

Les conceptacles très nombreux forment une multitude de petits points, puis de petits trous, dont la surface du thalle est véritablement piquetée; leur diamètre est de 150 à 300 μ.

En coupe on observe que le tissu est formé par le périthalle; l'hypothalle forme seulement la rangée basilaire de cellules qui

mesurent 10 à 12 μ de hauteur et 4 μ de largeur. Les cellules du périthalle mesurent 8 à 15 μ de longueur et peuvent atteindre 20 μ; leur largeur est 5 à 7 μ; les cloisons tangentielles sont épaissies et la disposition en rangées est généralement assez nette, surtout à la partie inférieure du thalle.

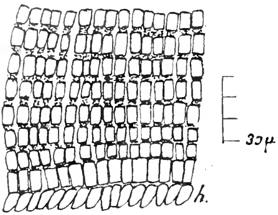

Fig. 157. Coupe verticale de la croûte de *Lithophyllum intermedium*. *h*, hypothalle.

St. Jan: Cruz Bay, No. 2196; Great Cruz Bay près de la côte No. 1783, 1782.

Répartition géographique. *L. intermedium* a été signalé aux Bermudes (Wadsworth in herb. Farlow); en Floride (Waerdeman herb. Farlow, in herb. Bornet); aux Antilles: Barbade (Vickers in herb. Bornet), Lassen (Herb. Børgesen), Jamaïque (Collins, Howe) et avec plus de doute à Porto-Rico, (Howe, No. 2346, voir Foslie 1906, p. 23).

5. **Lithophyllum daedaleum** Fosl. et Howe.

1906. *Lithophyllum daedaleum* Fosl. et Howe. New amer. Corall. alg., p. 133, pl. 83 et 84, pl. 93 (microphotographie); var. *pseudodentata* Fosl. et Howe, pl. 85, fig. 1.

1909. *Lithophyllum daedaleum* Fosl. et Howe; Foslie, Alg. Not. VI, p. 37.

Lorsque cette espèce atteint son complet développement, elle forme, sur les cailloux, des croûtes de 0 mm,5 à 2 mm d'épaisseur, qui donnent naissance à des mamelons irréguliers ou à des sortes de courtes branches, plusieurs fois ramifiées et souvent anastomosées; ces branches ont environ 2 mm d'épaisseur; elles sont très épaissies à leur sommet, souvent tronquées ou même déprimées en leur centre; lorsque ces branches sont irrégulièrement dilatées, elles apparaissent comme des replis de 3 à 15 mm d'épaisseur.

Dans la var. *pseudodentata*, la plupart des branches sont très comprimées et sont élargies en forme d'éventail à leur partie supérieure; elles peuvent ainsi atteindre une largeur de 2 cm.

Les échantillons de M. Boergesen se présentent simplement sous l'aspect de mamelons irréguliers prolongés par de fines épines; ils forment des thalles de 2 à 3 cm de hauteur.

La coupe étudiée traversait une portion de la croûte de 1 mm 600 μ d'épaisseur. A la partie inférieure du thalle on observe des files cellulaires très distinctement séparées les unes des autres; les cellules sont rectangulaires et mesurent 7 à 20 μ de longueur et 5 à 8 μ de largeur; les dimensions moyennes sont 12 à 17 μ × 7 μ; elles sont en général situées au même niveau dans les

différentes files; les cloisons se colorent fortement par les réactifs colorants.

Vers la partie supérieure de la coupe, le tissu prend un aspect plus compact: les files sont plus serrées et les cellules se disposent dans leur ensemble en rangées horizontales; les cellules pourvues chacune d'un pore, mesurent 10 à 22 $\mu \times 5$ à 12 μ. Enfin à ce second tissu ou périthalle secondaire, fait suite une écorce formée de très petites cellules rectangulaires très serrées, plus larges que hautes et disposées en rangées; leur dimension moyenne est 5 $\mu \times 10$ μ.

Suivant l'épaisseur de la croûte étudiée, elle peut être constituée soit seulement par le premier tissu (périthalle primaire) soit par les deux tissus superposés (périthalles primaire et secondaire). L'écorce peut se former à la suite du périthalle primaire et se trouver ainsi intercalée au milieu de l'épaisseur du tissu; les cellules de l'écorce se reconnaissent toujours à leur aspect et à leur faible coloration, par les réactifs, par rapport aux autres cellules.

L'hypothalle paraît être représenté par une unique rangée de cellules incolores à la base du thalle.

Les conceptacles à sporanges sont convexes, peu proéminents, de 250 à 380 μ de diamètre d'après les auteurs; les sporanges mesurent 60 μ de longueur et 30 à 35 μ de largeur.

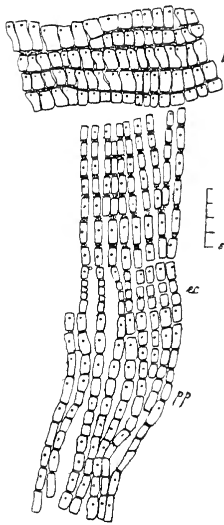

Fig. 158. Coupe verticale de *Lithophyllum daedaleum* montrant la superposition des différents tissus.

Les conceptacles à cystocarpes sont convexes, légèrement coniques, et mesurent 200 à 350 μ de diamètre. Les conceptacles à anthéridies sont encore inconnus.

St. Croix: Le port de Christiansted.

Répartition géographique. Cette espèce a été signalée aux Antilles: Porto-Rico: Salinas Bay près Guanica; Ile Culebra; Santurce; San Juan (Foslie et Howe 1906). Elle vivrait probablement aussi au Vénézuela: Margaritaoen, au Brésil (localité inconnue) et à l'Ile de la Trinidad (herb. du British Museum, échantillon nommé précédemment *L. pallescens*; voir Foslie, 1909, p. 37).

6. **Lithophyllum strictum** (Fosl.) Lem. var. **nana** Fosl. et Howe.

1901. *Goniolithon? (Cladolithon) strictum* Foslie, New Melob., p. 14.
1906. *Goniolithon strictum* Foslie; Foslie et Howe, New Amer. Corall. alg., p. 131, pl. 82, fig. 1.
1907. *Goniol. strictum* Foslie, Alg. Not. III, p. 16 (var. *fastigiata* Fosl.).

Lithophyllum strictum est une très jolie espèce formant un massif de branches très ramifiées ; l'aspect varie suivant le nombre de ramifications et le diamètre des branches; les branches sont dressées ou un peu courbées et s'amincissent légèrement vers la partie supérieure ; les ramifications sont souvent espacées et les branches prennent naissance fréquemment presque à angle droit sur les branches principales ; les dernières ramifications sont généralement bifurquées au sommet et les extrémités sont arrondies.

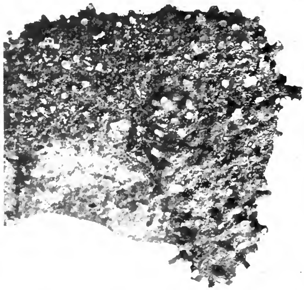

Fig. 159. Aspect extérieur de *Lithophyllum strictum* var. *nana*.

L'espèce ne paraît pas être représentée aux Antilles Danoises par des échantillons types ; M. Boergesen y a seulement trouvé la variété *nana* qui en diffère profondément d'aspect. Dans cette variété l'algue développe sur des cailloux une croûte à contours largement lobés; d'autres lobes peuvent se former çà et là sur la surface de la croûte; cette croûte ne s'épaissit pas et donne rapidement naissance à de petites branches cylindriques non ramifiées, de 1 mm environ de diamètre qui se dressent verticalement sur toute la surface de la croûte, sans dépasser 4 mm de hauteur.

En coupe les échantillons de la var. *nana* montrent un tissu formé de rangées de cellules rectangulaires très larges, mesurant 12 à 20 μ de longueur et 7 à 10 μ et même 15 et 17 μ de largeur.

Les cellules de la var. *nana* sont plus petites que celles des échantillons bien développés de *L. strictum* type ; ceux-ci, sur un échantillon de Floride m'ont montré des cellules de 16 à 33 μ $\times$ 12 à 13 μ, et Foslie a même observé en coupe longitudinale les dimensions suivantes 25 à 55 μ $\times$ 15 à 25 μ.

St. Croix: Longford; Long Reef, No. 1272, 1274; Christiansted.

Répartition géographique. *L. strictum* a été signalé aux Antilles; à la Jamaïque, à Porto-Rico; aux Bahamas d'où Howe en a rapporté de magnifiques échantillons; en Floride (Agassiz, herb. Farlow), Soldiers Key, Key West (Howe, Farlow in herb. Bornet).

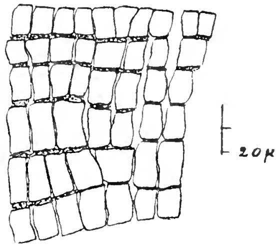

Fig. 160. Partie du tissu périphérique (périthalle) des branches de *Lithophyllum strictum*.

7. **Lithophyllum (?) absimile** Fosl. et Howe.

1907. *Lithophyllum absimile* Fosl. et Howe; Foslie, Alg. Not., IV, p. 27.

Je rapporte à cette espèce des croûtes de St. Jan dont l'aspect rappelle à première vue celui de *Lithophyllum intermedium;* la croûte est épaisse d'environ 1 mm, lobée et striée aux bords.

Les conceptacles sont très petits, très serrés et convexes; ils ne paraissent jamais être enfoncés dans le thalle ce qui les différencie de ceux de *Lit. intermedium*; les conceptacles observés en grand nombre mesuraient 100 à 150 μ et même 200 μ de diamètre; ces dimensions ne sont pas éloignées de celles indiquées par Foslie et Howe (120 à 160 μ de diamètre). Les sporanges n'ont pas encore été observés.

En coupe on observe un hypothalle bien développé; les cellules sont courtes, elles mesurent 10 à 12 μ, plus rarement 18 et 22 μ de longueur et 6 à 9 μ de largeur. Le périthalle, très épais, est formé de très petites cellules de 3 à 7 μ de longueur et 2 à 4 μ de largeur, en files séparées les unes des autres. Le périthalle est traversé par des lignes qui se colorent par les réactifs colorants, et qui sont distantes les unes des autres de 10 à 20 μ environ.

Les cellules périthalliennes rappellent celles de *L. caribaeum*; cette dernière espèce forme une croûte beaucoup plus mince et l'hypothalle est réduit. Ces deux espèces ne montrent pas la disposition en rangées caractéristique du genre *Lithophyllum* et doivent être considérées comme des espèces d'attribution incertaine.

Les croûtes de la collection de M. Boergesen ont été trouvées à St. Jan: Cruz Bay, No. 2196, No. 1783, sur une pierre en compagnie de *L. caribaeum*, *L. propinquum*, *L. intermedium*, St. Croix: Christiansted.

C'est sans doute la même espèce qui forme une croûte très abimée provenant de St. Croix; la structure y est altérée.

Répartition géographique. L'espèce n'a été jusqu'ici signalée qu'à la Jamaïque.

8. Lithophyllum (?) propinquum (Fosl.).

1900. *Goniolithon (Cladolithon) Notarisii* Duf., f. *propinqua* Fosl., New or crit. calc. alg. (1899), p. 21.
1906. *Gon. Notarisii* Duf., f. *propinqua* Fosl.; Foslie, Alg. Not., II, p. 15.
1907. *Gon. solubile* Fosl. et Howe; Foslie, Alg. Not., IV, p. 21.
1908. *Gon. propinquum* Fosl ; Foslie, Nye Kalkalger, p. 4 (f. *imbicilla* Fosl., f. *solubilis* Fosl. et Howe).

L. propinquum forme sur les pierres des croûtes à contour lobé, pourvues de gros conceptacles coniques; ces croûtes sont bien visibles fig. 161, où elles recouvrent *L. caribaeum*; elles sont elles-mêmes recouvertes à droite de la figure par *L. intermedium*. Stériles, les croûtes ont souvent une surface unie, sauf dans la var. *imbicilla* qui montre de petites lamelles, et dans la var. *solubilis* qui forme sur coraux des croûtes à surface inégale. Les croûtes se détachent assez facilement du substratum lorsqu'elles sont âgées.

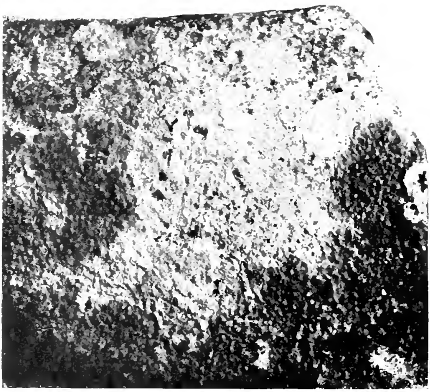

Fig. 161. Croûtes de *Lithophyllum propinquum* pourvues de conceptacles à cystocarpes. Au centre les croûtes blanches marquées d'un v appartiennent au *L. caribaeum*; à droite un thalle de *L. intermedium* marqué d'une double croix.

Les conceptacles souvent développés en grand nombre et très serrés, sont très larges à leur base et de forme générale conique ; le diamètre est de 300 μ à 1 mm. pour les conceptacles à sporanges, de 500 à 1200 μ pour les conceptacles à cystocarpes et de 300 μ pour les conceptacles à anthéridies. Les conceptacles sont prolongés par une épine caduque courte dans les conceptacles à cystocarpes et plus allongée dans ceux à sporanges. Les sporanges mesurent 90 à 160 μ de longueur et 40 à 60 μ de largeur; les carpospores observées dans une de mes coupes mesuraient 70 à 80 μ × 20 à 30 μ.

En coupe le tissu est formé d'un hypothalle et d'un périthalle.

L'hypothalle est formé de files serrées, rigides; les cellules, rectangulaires, mesurent dans les échantillons étudiés 15 à 35 μ de

longueur et 7 à 12 μ de largeur; cependant, d'après Foslie, elles atteindraient 55 μ de longueur.

Le périthalle est formé de cellules rectangulaires disposées à la fois en files et en rangées; le tissu présente un aspect compact, les cellules sont très serrées, elles mesurent 7 à 11 μ de hauteur, jusqu'à 25 μ et 5 à 12 μ de largeur.

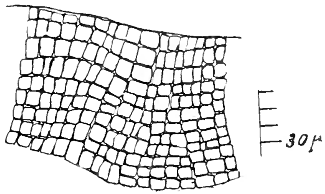

Fig. 162. Tissu périthallien de *Lithophyllum propinquum.*

L. propinquum rappelle l'espèce méditerranéenne *L. Notarisii* et aussi *L. pacificum* du Japon.

St. Jan: Cruz Bay, No. 2196; Great Cruz Bay, No. 1782; au large de Cruz Bay No. 2086 (var. *imbicilla*); No. 2095, No. 1917. St. Croix: Le port de Christiansted; St. Croix 1892. St. Thomas.

Répartition géographique. *L. propinquum* a été recueillie à Porto-Rico: Santurce, San Juan, Ile Culebra (Howe); à la Jamaïqne: Montego Bay (Howe); elle vit également à la Barbade, ainsi qu'en témoigne un échantillon de la collection Boergesen recueilli par Lassen; enfin, elle est connue en Floride à Key West (Hooper) et aux Bahamas (Howe).

9. **Lithophyllum (Dermatolithon) prototypum** Fosl.

1897. *L. prototypum* Foslie, On some Lith., p. 18.
1901. *Dermatolithon prototypus* Foslie, Rev. syst. surv. Melob., (1900), p. 22.
1901. *Goniolithon Udoteae* Foslie, New Melob., (1900), p. 21.
1909. *Lithophyllum (Derm.) prototypum* Foslie, Alg. Not. VI, p. 49. *Dermatolithon prototypum* Foslie, Alg. Not. VI, p. 58.

Dans la description de cette espèce je grouperai les caractères de *L. prototypum* et ceux de *L. Udoteae*; ces deux espèces ne m'ont pas paru présenter de caractères susceptibles de les distinguer l'une de l'autre; à mon avis *L. Udoteae* serait une variété de *L. prototypum* vivant sur algues.

L. prototypum forme sur les coraux et les coquilles, et sur algues, des croûtes minces, à contour lobé, montrant des stries concentriques à la marge; ces croûtes sont d'abord orbiculaires et se soudent ensuite pour former des croûtes de grande étendue; elles sont d'abord très adhérentes, ensuite moins fermement fixées au substratum; de nombreuses petites croûtes secondaires, également lobées au bord, prennent naissance sur la première croûte, dont toute la surface est ornée de petites lamelles orbiculaires très adhérentes; en regardant avec attention la fig. 163 on verra cette disposition très curieuse.

Les conceptacles à sporanges sont peu élevés au dessus de la surface du thalle, hémisphériques, légèrement déprimés au sommet, percés d'un pore visible à la loupe; après la maturité des spores il reste à la place du conceptacle une cicatrice circulaire.

Ils mesurent 350 à 600 μ de diamètre, principalement 400 à 500 μ; les sporanges mesurent 60 à 80 μ de longueur et 35 à 50 μ de largeur. Les conceptacles à cystocarpes ont une forme plus conique et mesurent 450 à 550 μ. Des conceptacles de 120 à 220 μ de diamètre, observés par M. Foslie sont sans doute des conceptacles à anthéridies.

La structure est en rapport avec la constitution de la croûte; chacune des petites croûtes secondaires est constitué par une rangée de cellules; en coupe on observe autant de rangées qu'il existait de croûtes superposées; on peut souvent en observer 6, quelquefois 12. Chacune de ces rangées est formée de hautes cellules rectangulaires pourvues chacune d'un ou deux pores; elles mesurent le plus souvent 25 à 35 μ de hauteur et 10 à 15 μ de largeur et se colorent très fortement par l'acide iodhydrique iodé; les cellules des rangées inférieures atteignent 40 μ, et plus rarement 65 et 85 μ, tandis que celles des rangées supérieures n'ont que 7 à 20 μ.

Fig. 163. *Lithophyllum* (*Dermatolithon*) *prototypum* sur coquille de *Pinna*.

Chaque rangée de cellules est recouverte par une rangée de cellules corticales de 3 à 5 μ de hauteur.

Comme dans toutes les espèces du sous-genre *Dermatolithon*, il y a une grande variation dans les dimensions des cellules suivant les rangées et même dans une même rangée. Les rangées, composées des cellules périthalliennes surmontées de leurs petites cellules corticales, s'individualisent souvent les unes des autres après décalcification et dans une coupe elles sont distantes les unes des autres (fig. 164).

Dans les échantillons étudiés la rangée de base ou hypothalle était formée de cellules assez semblables de forme à celles

des autres rangées; au contraire les autres espèces de *Dermatolithon* montrent généralement des cellules hypothalliennes obliques et contournées, très curieuses.

En résumé cette jolie petite espèce a un aspect très caractéristique, lorsqu'elle est développée sur des pierres, et ne peut être confondue avec aucune autre; sur algues (var. *Udoteae*) elle a un espace plus restreint pour se développer; elle forme de petits thalles circulaires qui rappellent ceux de *Lithophyllum pustulatum*. On peut cependant noter plusieurs différences essentielles: tout d'abord la formation de petites lamelles à la surface du thalle, même souvent sur des thalles de petite taille; puis, en coupe, la présence des cellules corticales surmontant les cellules de chacune

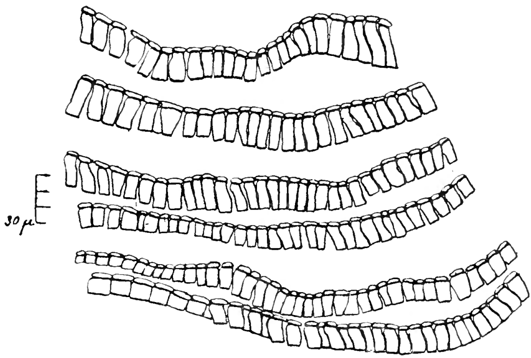

Fig. 164. Coupe à travers une croûte complexe de *Lithophyllum (Dermatolithon) prototypum*.

des rangées, tandis que dans l'espèce *L. pustulatum* il n'existe qu'une seule rangée de cellules corticales surmontant la dernière rangée de cellules périthalliennes; enfin comme il a été dit les rangées de cellules sont séparées les unes des autres dans les préparations; les dimensions des cellules et des conceptacles ne fournissent pas de caractères distinctifs de grande valeur.

St. Jan: Cruz Bay; au large de Cruz Bay, No. 1826, 2086; entre Cruz Bay et Great St. James, No. 2143; Great Cruz Bay, No. 1782. St. Croix: Longreef 1274, sur coquille.

var. *Udoteae*. St. Jan: Great Cruz Bay, sur *Galaxaura rugosa*, No. 1832; sur *Udotea flabellum*, No. 1729. St. Croix: Lagune de Christiansted, sur *Udotea flabellum*, No. 1305; Port de Christiansted, sur *Galaxaura rugosa*, No. 1232; Little Princess sur *Udotea flabellum*, 1892; Christiansted, No. 1272.

Répartition géographique. Jusqu'ici *L. prototypum* n'a pas été signalé en d'autres localités que celles mentionnées ici; elle sera sans doute découverte dans les régions avoisinantes ; j'ai en effet rapporté à cette espèce un échantillon indéterminé de l'Herbier BORNET recueilli par HOOPER en Floride, à Key West.

Melobesia Lmx.

1. Melobesia farinosa Lmx.

1866. *Melobesia farinosa* Lmx.; ROSANOFF, Mélob., p. 69, pl. II, fig 3 à 5, 10 à 12; pl. III, fig. 2 à 13; pl. IV, fig. 1, 10; pl. VII, fig. 12.
1905. *Melobesia farinosa* Lmx.; FOSLIE, Rem. north. Lith., p. 96.
1908. *Melobesia farinosa* Lmx.; FOSLIE, Alg. Not. V, p. 16 (f. *Solmsiana* Falk.).

Melobesia farinosa forme sur un grand nombre d'algues de petites croûtes très minces, généralement circulaires, qui montrent sur les échantillons secs des stries radiales et des stries circulaires; la surface en est quelquefois poudreuse, d'où son nom.

Cette espèce a été remarquablement bien décrite et bien étudiée par ROSANOFF. Elle est, en principe, très facile à déterminer au microscope, par un simple examen superficiel du thalle, sans faire de coupes dans le tissu, grâce à la présence très fréquente de cellules spéciales nommées *hétérocystes*. On observe en effet que parmi toutes les files de cellules, certaines se sont arrêtées dans leur croissance et sont terminées par une cellule plus grosse que les autres (fig. 165 *b*, *c*); cette cellule reste souvent incolore lorsque le reste du tissu est coloré par un réactif colorant, ou sinon se colore moins fortement que les autres cellules. Les files de cellules adjacentes prennent la place de la file arrêtée dans son développement, d'où il résulte, ainsi que l'a signalé le premier ROSANOFF, un aspect sinueux des files de cellules.

L'abondance des hétérocystes est très variable suivant les échantillons étudiés (voir à ce sujet FOSLIE 1909), sans qu'il ait été possible jusqu'ici d'émettre une hypothèse sur les causes qui amènent la formation des hétérocystes. Dans les échantillons des Antilles Danoises quelques uns même ne m'ont pas montré d'hétérocystes; d'après les dimensions des cellules et l'aspect du tissu j'ai cru cependant devoir les ranger dans la même espèce, mais je les ai inscrits à part dans la liste des localités page 173. Dans cette espèce la dimension des cellules est très variable et varie en particulier suivant la nature du support; c'est ainsi que sur Zostère elles sont de plus grande dimension que sur les autres supports, constatation déjà faite par FOSLIE; en effet dans la plupart des échantillons des Antilles Danoises, les cellules mesurent

7 à 15 μ de longueur et 5 à 10 μ de largeur; sur Zostère elles mesurent 15 à 22 $\mu \times$ 7 à 12 μ. De même dans des échantillons de la Méditerranée la dimension des cellules est de 12 à 20 $\mu \times$ 7 à 10 μ, sauf sur zostère où elle est de 18 à 30 $\mu \times$ 15 à 18 μ. Tout en tenant compte de cette variabilité, on remarquera cependant que *M. farinosa* a des cellules de plus petite dimension aux Antilles qu'en Méditerranée. En résumé on peut dire que dans cette espèce la dimension des cellules, vues de dessus, sans faire de coupe, varie entre 7 et 30 μ et celle des hétérocystes entre 22 et 40 μ.

Les cellules de *M. farinosa* sont de forme rectangulaire; leurs cloisons se colorent fortement par les réactifs en particulier par l'acide iodhydrique iodé; ces cloisons sont en général situées au même niveau dans les différentes files et s'alignent suivant des lignes concentriques (fig. 165, *a*, *b*, *c*; voir aussi les figures de Rosanoff).

Dans les échantillons que je range avec les auteurs dans la type de l'espèce, les files cellulaires présentent une assez grande cohésion: le tissu a, par suite, un aspect compact et régulier (fig. 165 *a*, *b*); mais, dans d'autres échantillons les files cellulaires sont plus lâches (fig. 165 *c*, *d*) ou même paraissent couvrir individuellement sur le substratum (fig. 165 *e*), en affectant un aspect irrégulier très curieux.

J'ai pu observer toutes les transitions entre ces types de structure si différents au premier abord et j'arrive, pas suite à la même conclusion que Foslie qui rangeait les thalles à structure lâche dans la variété *Solmsiana* Falk. [1]) du *Melobesia farinosa*. Dans la variété *Solmsiana* les hétérocystes sont généralement circulaires, tandis que dans le type de l'espèce ils sont le plus souvent allongés.

Toutes les descriptions qui précèdent s'appliquent à l'étude du thalle vu à plat, tel qu'il se présente sur les plantes qui lui servent de support. En coupe verticale, au contraire, le tissu est formé de trois rangées de cellules, la rangée médiane étant plus grande que les deux autres.

Les conceptacles à sporanges et à cystocarpes mesurent 140 à 250 μ de diamètre et atteignent 300 μ dans la variété *borealis*.

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[1]) Cette variété, appelée *Melobesia callithamnioides* par Falkenberg 1879 et Solms Laubach (Corallinaceae d. Golf. von Neapel 1881) fut appelée *Melobesia Solmsiana* par Falkenberg (Rhodomelaceen d. Golf. von Neapel 1901. Fauna und Flora des G. v. Neapel, p. 109) pour éviter toute confusion avec le *M. callithamnioides* Crouan.

Les conceptacles à anthéridies mesurent 60 à 80 μ. D'après Rosanoff, les cellules qui entourent l'orifice des conceptacles à sporanges sont un peu allongées et relevées ; ce caractère paraît assez difficile à observer sur des échantillons secs.

Les sporanges mesurent d'après Foslie 50 à 90 $\mu \times$ 30 à 50 μ; j'ai observé dans un thalle sur zostère, de Christiansted, des sporanges de 40 à 50 $\mu \times$ 20 à 40 μ.

Comme support *M. farinosa* type a été signalé sur *Fucus*, *Laminaria*, *Cystosira*, *Padina*, *Sargassum*, *Chondrus*, *Rhodymenia*,

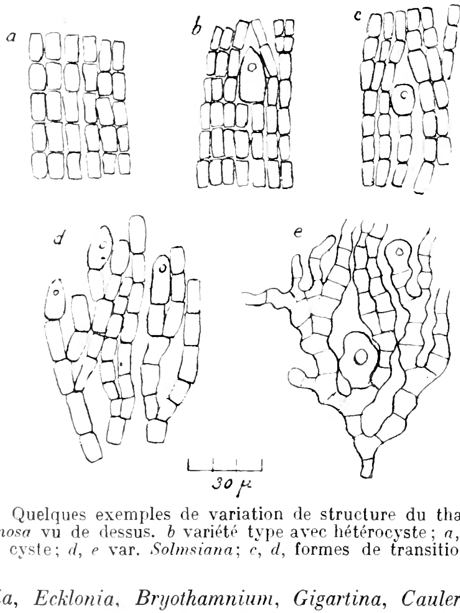

Fig. 165. Quelques exemples de variation de structure du thalle de *Melobesia farinosa* vu de dessus. *b* variété type avec hétérocyste ; *a*, sans hétérocyste ; *d*, *e* var. *Solmsiana* ; *c*, *d*, formes de transition.

Laurencia, *Ecklonia*, *Bryothamnium*, *Gigartina*, *Caulerpa*, *Carpacanthus*, *Chaetomorpha*, *Cymodocea*, *Posidonia*, *Potamogeton*, *Thalassia*, *Enalis* et *Zostera*.

La variété *Solmsiana* a été signalée par Foslie sur *Peyssonnelia*, sur tubes chitineux d'hydroides, sur tubes de Serpules ; Sauvageau l'a recueillie sur *Valonia*, sur *Cystosira*, sur *Aglaozonia* aux Canaries. Falkenberg l'a récolté à Naples sur *Aglaozonia*.

Melobesia farinosa type (avec hétérocystes).

St. Croix : Little Princess, sur *Udotea flabellum* ; Cassavagarden, No. 1389, sur *Udotea flabellum* ; Christiansted zur Zostère ; Christiansteds' Lagoon,

sur *Udotea flabellum*; Port de Christiansted, No. 1228, sur *Gelidium corneum*; Coakley Bay, No. 1358, sur *Padina St. Crucis*; près Christiansted sur coquille —; sur *Padina* leg. Hansen; White Bay, No. 1555, sur *Valonia macrophysa*. St. Thomas: Ouest de Water Island, No. 1777, sur *Valonia ventricosa*, profondeur 30 mètres; près de Water Island, No. 1101, sur *Udotea cyathiformis*, profondeur 30 mètres. St. Jan: Cruz Bay, No. 1822, sur *Udotea flabellum*; idem sur *Halimeda discoidea*, profondeur 30 mètres; idem No. 1867, sur *Struvea elegans*, profondeur 30 mètres; au large d'America Hill, No. 2014, sur *Halimeda*; au large d'Hermitage, No. 2166, sur *Zonaria variegata* profondeur 30 mètres.

2) Sans hétérocystes.

St. Croix: Christiansted sur Zostère; Long Reef sur *Penicillus capitatus*; côte sud de l'île, sur *Halimeda incrassata*, leg. Hansen; Great Ponds strand, No. 1369, sur *Valonia aegagropila*. St. Thomas: Port de Charlotte Amalia No. 120, sur *Halophila*; près Water Island, No. 1172, sur *Halimeda incrassata* var *simulans*, profondeur 30 mètres; No. 119 sur *Halophila*. St. Jan: Coral Bay, No. 140 B.

3) *Melobesia farinosa* var. *Solmsiana*.

St. Jan: Coral Bay No. 140 A; près de Great St. James, No. 2087, sur *Zonaria variegata*, profondeur 30 mètres; au large de Cruz Bay No. 1763 B, sur *Udotea flabellum*, profondeur 30 mètres. St. Croix: Port de Christiansted No. 1311 sur *Gelidium corneum*; Judith Fancy, sur *Turbinaria trialata*; Cane Bay, sur *Udotea flabellum* No. 1424. St. Thomas: Ouest de Water Island, No. 1173 C, sur *Udotea flabellum*, profondeur 30 mètres.

Répartition géographique. *Melobesia farinosa* est une espèce très commune, connue dans toutes les mers du globe; aux Antilles elle a été signalée à Cuba, à la Jamaïque, à Porto-Rico, à la Guadeloupe, à la Desirade, à la Barbade et à la Martinique. C'est cette espèce qui a été désignée par Mazé et Schramm sous le nom de *Melobesia confervicola*. La variété *Solmsiana* paraît vivre dans les mers assez chaudes; en Méditerranée elle a été signalée à Naples (Falkenberg, Solms); à Rhodes (Nemetz in Reinbold, Hedwigia, XXXVII, p. 87, 1898); dans l'Adriatique (Hauck, Wille); aux Canaries (Sauvageau); Bahamas (Howe). Aux Antilles Danoises elle est aussi commune que le *M. farinosa* type.

2. **Melobesia (Pliostroma) Chamaedoris** Fosl. et Howe.

1906. *Lithophyllum Chamaedoris* Foslie et Howe, New Am. Corall. alg., p. 134, pl. 90, fig. 1.
1908. *Lithophyllum Chamaedoris* Fosl. et Howe; Foslie, Alg. Not. V, p. 17.
1908. *Melobesia (Pliostroma) Chamaedoris* Fosl. et Howe; Foslie, Pliostr. a new subg., p. 6.

Cette petite espèce forme sur les *Chamaedoris* des croûtes d'une épaisseur de 60 à 150 μ qui entourent plus ou moins complètement les tiges de ces algues; leur surface est lisse, et la couleur d'un rouge assez vif.

Les conceptacles à cystocarpes sont convexes ou subconiques de 150 à 200 μ de diamètre d'après les auteurs; dans les échantillons de M. BOERGESEN la dimension la plus fréquente est 180 μ; la partie centrale du toit s'affaisse après maturité et disparaît, et il reste ensuite la partie périphérique formant rebord autour de la petite cavité centrale.

Comme dans tous les *Pliostroma* le thalle est composé de plusieurs rangées de cellules; on peut en observer jusqu'à 12; les cellules mesurent 7 à 13 μ de longueur et 8 à 10 μ de largeur; dans la partie périphérique, le thalle n'est formé que d'une seule rangée.

Vues de dessus, sans faire de coupe, les cellules mesurent 8 à 17 μ de longueur et 7 à 13 μ de largeur; elles sont arrondies, toutes semblables de forme, et constituent un tissu d'aspect régulier.

Par son aspect *M. Chamaedoris* rappellerait d'après Foslie *Epilithon marginatum* de la côte pacifique des Etats-Unis. — Le thalle est d'autre part plus épais et d'un aspect plus unique celui de *M. farinosa*; vues de dessus les cellules se distinguent de celles de *M. farinosa* par leur forme; dans cette dernière espèce elles sont rectangulaires et sont disposées en rangées; de plus il n'y a pas de cellules hétérocystes dans *M. Chamaedoris*.

St. Jan: Rams Head, sur *Chamaedoris annulata*, profondeur 40 mètres No. 1940. St. Croix: côte sud de l'île, Mars 1892, sur *Cham. annulata*; White Bay, No. 1530 et 1575 sur *Cham. annulata*.

Répartition géographique. Iles Bahamas.

Position systématique du sous-genre Lithoporella.

Le sous-genre *Lithoporella*, auquel appartient l'espèce *L. atlantica*, a été d'abord placé par M. FOSLIE dans le genre *Mastophora*, puis a été considéré par lui comme un genre distinct. J'en fais ici un sous-genre de *Melobesia*. Pour comprendre cette manière de voir il n'est pas inutile de rappeler les conceptions successives de M. FOSLIE au sujet de ces espèces, de classement difficile, pour comprendre la modification que je propose ici.

Le genre *Mastophora* a d'abord été divisé par M. FOSLIE en trois sous-genres:

1) *Eumastophora*; ce sous-genre réunissait les espèces à fronde membraneuse, divisée ou laciniée, peu calcifiée et par suite flexible; il y plaçait les espèces: *M. Lamourouxi*, *M. macrocarpa*, *M. plana* et aussi *M. affinis* bien que dans cette dernière espèce le thalle ne soit pas divisé.

2) *Lithoporella* et *Lithostrata* groupaient les espèces dont le thalle est fortement incrusté et par suite cassant.

Lithoporella comprenait les espèces dont le thalle est formé d'une seule rangée de cellules[1]), sauf dans la région des conceptacles (*M. pacifica* (Heyd.) Fosl., *M. melobesioides* Fosl., *M. conjuncta*, *M. atlantica* Fosl.); il s'opposait à *Lithostrata*, représenté par la seule espèce *M. lapidea* dont le thalle est formé de nombreuses rangées.

Les sous-genres *Lithoporella* et *Lithostrata* ont été retirés du genre *Mastophora*; en effet à moins de modifier la définition de ce genre on pouvait difficilement y laisser des espèces formant des croûtes semblables à celles des Lithothamniées; aussi *Lithoporella* avait été considéré par M. Foslie comme un genre distinct de *Mastophora* et ayant des affinités avec *Melobesia*; à mon avis les *Lithoporella* ne peuvent pas être séparé des *Melobesia*; elles représentent une simplification de structure des *Pliostroma*, sous-genre de *Melobesia*, dont le thalle est formé de plusieurs rangées de cellules et d'une seule rangée au bord. Il me paraît donc logique de considérer *Lithoporella* comme un sous-genre de *Melobesia*; il serait caractérisé par la grandeur des cellules et des conceptacles qui dépassent de beaucoup celles des autres espèces de *Melobesia*.

3. **Melobesia (Lithoporella) atlantica** (Fosl.) Lem.

1906. *Mastophora (Lithoporella) atlantica* Foslie, Alg. Not. II, p. 27.
1909. *Lithoporella atlantica* Foslie, Alg. Not. VI, p. 59.

Cette espèce forme de petites croûtes minces, de peu d'étendue, qui poussent parmi les Bryozoaires, sur les polypiers morts; elle ne peut se reconnaître à l'aspect que lorsqu'elle est fructifiée, grâce à ses gros conceptacles coniques; les conceptacles mesurent 500 à 800 μ de diamètre; les sporanges sont inconnus.

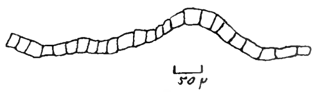

Fig. 166. Thalle de *Melobesia (Lithoporella) atlantica* formé d'une seule rangée de cellules.

Le thalle est généralement formé par une rangée unique de cellules, plus rarement par deux; les dimensions que j'ai observées sont 18 à 32 μ pour la hauteur et 10 à 25 μ pour la largeur;

[1]) Dans les *Lithoporella* de nombreuses croûtes peuvent se superposer les unes aux autres et en coupe on peut observer de nombreuses rangées; mais chaque croûte n'est constituée que par une seule rangée.

cependant des dimensions plus considérables ont été observées par M. Foslie : 32 à 60 μ de hauteur et 18 à 40 μ de largeur.

Cette espèce rappelle d'après Foslie le *M. melobesioides* de l'Océan Indien et de l'Archipel Malais et s'en distingue par ses conceptacles plus petits et ses cellules plus larges.

St. Jan: Au large de Cruz Bay, No. 2095, 1727.

Répartition géographique. Cette espèce n'a pas été signalée en d'autres localités.

4. Melobesia (Litholepis) affinis (Fosl.) Lem.

1906. *Litholepis affinis* Foslie, Alg. Not. II, p. 17.

Cette très petite espèce forme des croûtes extrêmement minces et peu calcifiées ; l'aspect est souvent semblable à celui d'une poussière qui serait répandue à la surface des coquilles ou des cailloux ; à la loupe on observe des multitudes de petits thalles qui se réunissent en s'accroissant et forment alors un petit thalle de forme à peu près circulaire, lobé aux bords ; on remarque quelquefois la formation d'un nouveau thalle dans la partie centrale d'un thalle ancien.

Les conceptacles de forme hémisphérique-conique, mesurent d'après Foslie, les uns 170 à 260 μ, les autres 60 à 120 μ ; les sporanges sont encore inconnus. Je n'ai pas observé de coupe verticale du thalle ; d'après Foslie les cellules mesurent 14 à 22 μ de longueur et 9 à 18 μ de largeur.

M. affinis montre une assez grande ressemblance avec *M. (L.) bermudensis* Fosl. et *M. (L.) Sauvageaui.*

Position systématique du sous-genre Litholepis.

M. affinis, placée par Foslie dans le genre *Litholepis* me paraît devoir être rattachée aux *Melobesia*, en ne voyant en *Litholepis* qu'un sous-genre. M. Foslie (New Lith. 1905, p. 5) avait d'ailleurs insisté sur les relations de ces deux genres : en particulier les conceptacles à sporanges sont semblables. Au point de vue de la structure, les espèces du genre *Litholepis* ont un thalle formé d'une seule rangée de cellules ; cette structure peut à mon avis résulter d'une simplication de celle de certaines espèces comme *M. farinosa* ou *M. Lejolisii* dans lesquelles le tissu stérile est composé de 3 rangées de cellules seulement, dont deux très petites ; autour d'un conceptacle le nombre des rangées augmente dans le genre *Melobesia* de même que dans le genre *Litholepis.*

Litholepis pourrait donc être considéré comme un sous-genre de *Melobesia* caractérisé : 1) par sa nature saxicole 2) par son

thalle monostromatique 3) par la superposition de croûtes les unes au dessus des autres.

Les espèces de *Litholepis* connues jusqu'ici sont: *M.* (*L.*) *caspica* Fosl., *M.* (*L.*) *bermudensis* Fosl., *M.* (*L.*) *Sauvageaui* Fosl., *M.* (*L.*) *indica* Fosl.

Le sous-genre *Litholepis* a certains caractères communs avec *Lithoporella* que je considère également comme un sous-genre de *Melobesia*; la structure est monostromatique, et il y a superposition de croûtes dans les deux cas.

Mais dans le sous-genre *Lithoporella* les conceptacles sont beaucoup plus gros, les cellules sont plus grandes et le thalle plus épais.

St. Jan: Au large d'America Hill, No. 2072; No. 1967 (profondeur 16 brasses) No. 2104. St. Croix: Northside, sur roches exposées, No. 1468; Longford.

Répartition géographique. *M. affinis* n'a pas été signalé en d'autres localités.

Porolithon.

1. **Porolithon mamillare** (Harv.) Lem. var. **occidentalis** Fosl.

1847. *Melobesia mamillaris* Harvey, Nereis australis, t. XLI, p. 109.
1906. *Goniolithon mamillare* Harv.; Foslie, Alg. Not. II, p. 15 (f. *occidentalis* Fosl.).
1909. *Gon. mamillare* Harv.; Foslie, Alg. Not. VI, p. 10.

Les échantillons de *P. mamillare* des Antilles Danoises forment des croûtes lobées au bord surmontées de nombreuses petites épines cylindriques de 3/4 de mm. à 1 mm. 1/2 de hauteur environ.

Sur la première croûte il y a souvent formation de petites lamelles orbiculaires, formées çà et là au milieu des épines, et qui n'adhèrent pas complètement à la croûte.

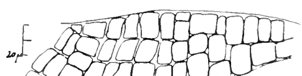

Fig. 167. Coupe verticale du thalle de *Porolithon mamillare*.

Les conceptacles sont très gros, coniques, renflés dans leur partie médiane; leur diamètre atteint 1 mm,4 environ.

En coupe, le tissu est formé de grosses cellules à parois minces, peu colorées par l'acide iodhydrique, elles sont disposées irrégulièrement et mesurent 10 à 20 μ de longueur et 7 à 15 μ de largeur; l'hypothalle est représenté par la rangée basilaire de cellules, soit peu différentes comme forme et comme dimension des autres cellules du tissu, soit plus allongées (20 à 22 μ × 12 μ).

Dans les prolongements en forme d'épines qui surmontent la croûte, les cellules ont à peu près la même dimension que dans la croûte: 5 à 15 μ, principalement 5 à 7 μ de longueur.

Por. mamillare var. *occidentalis* se différencie peu, d'après Foslie, de *P. mamillare* type, des côtes d'Afrique. Cette espèce était placée par Foslie dans le genre *Goniolithon*, genre non homogène dans lequel les espèces présentaient des types de structures très variés. Par l'irrégularité de son tissu, cette espèce me paraît, ainsi que *P. Boergesenii*, être mieux placée dans le genre *Porolithon*, à côté de *P. Reinboldi*.

St. Jan: Au large de Cruz Bay, No. 2095, 1879 et No. 1826 (échantillons abimés); au large de l'Hermitage, No. 2181. St. Croix: Northside sur roches exposées, No. 1468 — idem récolté en 1892. St. Thomas: No. 1030. Un échantillon de Quenstedt de 1848 appartient à cette même espèce.

Répartition géographique. Un échantillon indéterminé de l'herbier Bornet, de Key West, Floride (herb. Farlow), appartient à cette espèce. Cette espèce vivrait également aux Iles du Cap Vert (Challenger Exp., Dicki 1875 et 1877); au Cap Vert à St. Jago (Harvey 1847); à St. Vincent; à Algoa Bay (Bowerbank in Harvey 1847), sur la côte africaine; au Brésil: à Bahia (Harvey 1847). Peut-être faudra-t-il revoir certaines des localités signalées par Harvey, en particulier celles de Port Famine (Terre de Feu) (Darwin in Harvey 1847). L'espèce signalée à Tongatabu dans l'Océan Pacifique (Dickie) est le *L. erubescens* Fosl.

2. Porolithon Boergesenii (Fosl.) Lem.

1901. *Goniolithon (Herpolithon) Boergesenii* Foslie, New Melob. p. 19.
1907. *Goniolithon (Hydrolithon) Boergesenii* Foslie, Alg. Not. III, p. 20 (var. *africana* Fosl.).

Les échantillons recueillis par M. Boergesen montrent cette espèce à divers états de développement; l'un d'eux forme une croûte d'environ 3 mm. d'épaisseur développée sur une tige de corail; la surface en est irrégulière; d'autres, plus âgés, forment, sur des massifs de polypiers, des croûtes mamelonnées ainsi qu'on le voit sur la fig. 168.

L'algue jeune peut former une croûte unie, ainsi qu'en témoignent les échantillons des Bahamas distribués par Howe (North American Marine Algae).

On a signalé une certaine variation dans l'aspect de cette espèce, suivant la nature du substratum; il arrive quelquefois que des thalles de Bryozoaires se développent sur des croûtes de *P. Boergesenii* et que celui-ci recouvre à son tour les thalles de Bryozoaires; il s'ensuit que l'algue présente des aspects variables et que la structure peut se trouver tout à fait altérée.

Ainsi que l'a remarqué Foslie, le tissu hypothallien est représenté par une seule rangée de cellules étroites, placées côte à côte, de 20 à 25 μ de longueur et 8 μ de largeur. Le tissu périthallien

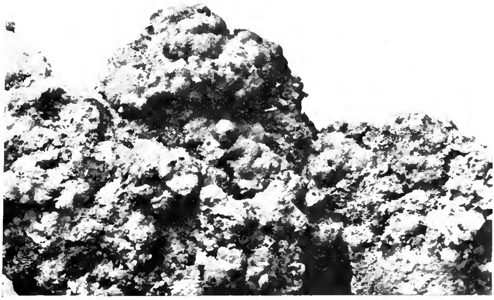

Fig. 168. Croûtes de *Porolithon Boergesenii.*

est formé de cellules très variables de forme, ici rectangulaires, là ovoides, disposées de telle sorte qu'il est difficile de suivre l'enchaînement des cellules constituant chaque file verticale.

Les cellules mesurent 7 à 18 μ de longueur et 8 à 12 μ de largeur; quelques cellules plus grosses de 20 à 25 μ $\times$ 18 à 20 μ sont dispersées ça et là dans le tissu.

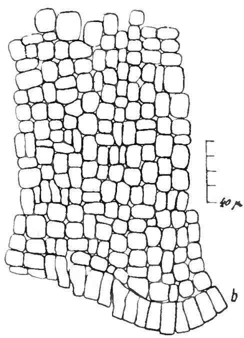

Fig. 169. Coupe verticale à travers le thalle de *Porolithon Boergesenii*; *b*, hypothalle.

Les cellules prennent, suivant les régions du thalle, une coloration plus ou moins vive sans l'influence du réactif colorant, de sorte que dans son ensemble le tissu est traversé par des zones de coloration variable.

P. Boergesenii rappelle beaucoup *Por. Reinboldi* de l'Océan Pacifique, par son tissu irrégulier, son hypothalle formé d'une seule rangée de cellules, et par la présence au milieu du périthalle de grosses cellules disséminées.

Les caractères suivants permettent de les différencier :

1) Les cellules de l'hypothalle sont plus petites dans *P. Reinboldi* (16 à 22 μ $\times$ 10 à 20 μ).

2) Les cellules du périthalle sont, dans l'ensemble, plus grandes dans *P. Reinboldi* (15 à 24 $\mu \times$ 6 à 15 μ).

3) Il n'existe pas de zones de coloration visibles dans le tissu de *P. Reinboldi* après action des réactifs.

4) On trouve fréquemment la présence d'écorces anciennes dans le tissu de *P. Reinboldi.*

5) Les conceptacles à sporanges mesurent 300 à 400 μ de diamètre dans *P. Boergesenii* et 350 à 700 μ dans *P. Reinboldi.*

St. Croix: Plusieurs échantillons, en particulier l'un de Long Reef, Baie de Christiansted, No. 1272.

Répartition géographique. En dehors des Antilles Danoises *P. Boergesenii* a été signalé aux Iles Bahamas (Howe), à la Barbade (échantillon de M[lle] VICKERS 1902 in herb. BORNET et voir aussi FOSLIE 1901, p. 21).

La présence de cette espèce a été signalée sur la côte africaine à San Thomé (Golfe de Guinée) par FOSLIE (1907) et HARIOT (1908) d'après les échantillons du Muséum d'Historie Naturelle de Paris récoltés par M. GRAVIER. Ainsi que je l'ai dit plus haut (p. 149) ce qui reste actuellement de l'échantillon ne permet plus de l'étudier, et de savoir si contrairement aux données que l'on possède sur les affinités des êtres du Golfe de Guinée, *P. Boergesenii* y est réellement représenté par une variété africaine.

3. **Porolithon pachydermum** Fosl.

1904. *Lithophyllum oncodes* Fosl., f. *pachyderma* Fosl., Alg. Not. V, p. 5.
1909. *Lithophyllum (Porolithon) pachydermum* Fosl., Alg. Not. VI, p. 41 (f. *nexilis* Fosl. et Howe).

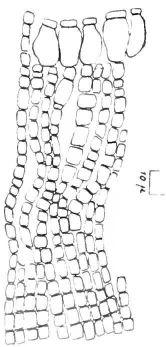

Fig. 170. Coupe verticale de la croûte de *Porolithon pachydermum* montrant un groupe de 5 grosses cellules.

Cette espèce se développe sur les coraux et les pierres et y forme des croûtes minces dont l'aspect n'a rien de caractéristique et peut être confondu facilement avec d'autres espèces par exemple *L. propinquum*, *Por. oncodes*, *L. intermedium* jeune etc.

Les conceptacles à sporanges sont convexes, peu saillants, de 150 à 250 μ vue de la surface; les sporanges mesurent 60 à 70 μ de haut et 30 à 40 μ de large. Les conceptacles à cystocarpes sont convexes, de 200 à 300 μ de diamètre.

En coupe on observe à la base un hypothalle peu développé formé de cellules courtes qui mesurent 8 à 17 μ de longueur et 4 à 10 μ de largeur. Le périthalle a un aspect compact; les cellules sont petites, larges par rapport à leur hauteur et généralement très serrées; on peut cependant observer dans certaines parties

(fig. 170) des files séparées les unes des autres; les cellules mesurent 4 à 8 μ ou 8 à 11 μ de hauteur et 5 à 12 μ de largeur. Au milieu du tissu existent ça et là de grosses cellules, disposées par groupes de 8; elles sont bien visibles et mesurent 17 à 20 $\mu \times$ 8 à 15 μ. La présence de ces groupes de cellules différencie cette espèce de toutes les autres espèces des Antilles Danoises. Par rapport aux espèces des régions plus éloignées, elle montre des affinités évidentes avec *Por. oncodes* de l'Océan Indien et de l'Océan Pacifique (Funafuti, Puamotou, Sumatra, N[elle] Guinée). Les deux espèces se différencient par un certain nombre de caractères; les grosses cellules sont dans *L. oncodes* par groupes de 3, 5 ou plus rarement 8; les cellules du tissu sont dans l'ensemble plus hautes et moins larges.

St. Jan: Cruz Bay; Great Cruz Bay No. 1782. Des échantillons de la collection de M. Boergesen et provenant de Quenstedt, 1848, sans localité, doivent être rapportés à cette espèce.

Répartition géographique. *P. pachydermum* a été signalé aux Bahamas (Howe) (f. *nexilis*) et à la Jamaïque. Un échantillon de *L. intermedium* de la Barbade récolté par Lassen, de la collection Boergesen recouvre une croûte de cette espèce.

Bibliographie.

Collins. The algae of Jamaïca. Proceedings of the American Academy of Arts and Science, t. XXXVII, No. 9. Boston 1901.

Foslie. 1897. On some Lithothamnia. Det Kongelige norske Vidensk. Selskabs Skrifter, 20 pages. Trondhjem 1897, No. 1.

— 1900. New or critical calcareous algae. Det K. n. Vid. Selsk. Skrifter. Trondhjem (1899) 1900, No. 5, 34 pages.

— 1901. Revised systematical survey of the Melobesiæ. D. K. n. Vid. Selsk. Skrifter. Trondhjem (1900) No. 5, 1901, 22 pages.

— New Melobesiæ. D. K. n. Vid. Selsk. Skrifter. Trondhjem (1900) 1901, No. 6, 24 pages.

— 1904. Algologiske Notiser I. D. K. n. Vid. Selsk. Skrifter. Trondhjem 1904, No. 2.

— 1905. Den botaniske samling. Kgl. norske Vid. Selsk. Aarsberetning for 1904. Trondhjem 1905.

— 1905. Remarks on northern Lithothamnia. D. Kgl. n. Vid. Selsk. Skrifter. Trondhjem 1905, 138 pages.

— 1906. Algologiske Notiser II. D. Kgl. n. Vid. Selsk. Skrifter. Trondhjem 1906, No. 2.

— 1907. Algologiske Notiser III. D. K. n. Vid. Selsk. Skrifter. Trondhjem (1906), No. 8, paru 1907.

— 1907. Algologiske Notiser IV. D. K. n. Vid. Selsk. Skrifter. Trondhjem 1907, No. 6.

— 1908. Algologiske Notiser V. D. K. n. Vid. Selsk. Skrifter. Trondhjem 1908, No. 7, 20 pages.

FOSLIE. 1908. Nye Kalkalger. D. K. n. Vid. Selsk. Skrifter. Trondhjem 1908, No. 12, 9 pages.

— 1908. Pliostroma, a new subgenus of *Melobesia*. D. K. n. Vid. Selsk. Skrifter. Trondhjem 1908, No. 11.

— 1909. Algologiske Notiser VI. D. K. n. Vid. Selsk. Skrifter. Trondhjem 1909, No. 2.

FOSLIE et HOWE. New American Coralline algæ. Bull. of the New York Botan. Garden, vol. IV, No. 13, 8 pages, 14 pl. New York 1906.

HARVEY. Nereis australis or algae of the Southern Ocean. Londres 1847—49.

LEMOINE (Mme Paul). Structure anatomique des Mélobésiées (application à la classification). Annales Inst. Océanographique de Monaco, t. II, fasc. 1, 105 fig., 5 pl. Monaco 1911.

MAZÉ et SCHRAMM. Essai de classification des algues de la Guadeloupe, 2ème édition. Basse-Terre 1870—1877.

ROSANOFF. Recherches anatomiques sur les Mélobésiées. Mém. Soc. imp. Sc. nat. et math. de Cherbourg, [2], II, XII, 112 pages, 7 pl., 1866.

WEBER et FOSLIE. The Corallinaceae of the Siboga Expedition. Siboga Expeditie LXI, 16 pl., 34 fig. texte. Leyden 1904.

Subfam. 2. **Corallineæ.**

Amphiroa Lamx.

1. **Amphiroa rigida** Lamx.

LAMOUROUX, I. V. F., Histoire des Polyp. corall. flexibl., vulg. nommés Zoophytes, Caen 1816, p. 297, tab. XI, fig. 1. ZANARDINI, G., Iconographia, vol. 3, p. 79, tab. 99, fig. B. ARESCHOUG, I. E., Corallineæ in J. AGARDH, Spec. Alg., vol. II, pars I, p. 532. SOLMS-LAUBACH, Die Corallinenalgen des Golfes von Neapel, p. 6, tab. 1, figs. 1, 11 (Fauna u. Flora d. Golf. v. Neapel, 4. Monogr. 1881). YENDO, K., Corallinae verae Japonicae, 1902, p. 6, pl. I, figs. 5—6, pl. IV, fig. 4; Revised List of Corallinæ, 1905, p. 3. WEBER-VAN BOSSE, A., Corallinae verae of the Malay Archipelago (in A. WEBER-VAN BOSSE and M. FOSLIE, The Corallinaceae of the Siboga-Expedition, 1904).

var. *Antillana* nov. var.

A forma typica præcipue differt, planta majore, cæspitibus usque ad 6 cm. altis, ramificatione magis regulariter dichotoma, ganulis sæpe obtusis.

The specimens found were growing in large, dense tufts, about 6 cm. high. They are fairly richly ramified, and the ramification is mostly a very regularly dichotomous one (Figs. 171 and 172). The filaments are thickest in the lower part, about 1—1,5 mm.,

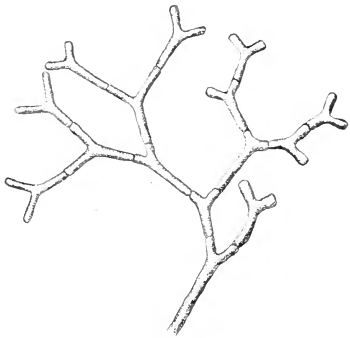

Fig. 171. *Amphiroa rigida* Lamx. var. *Antillana* nov. var. Part of a regularly dichotomous thallus. (About 2 : 1).

and taper evenly to the summit where often the diameter scarcely reaches half the length of the above mentioned size. In the basal part the colour of the dried specimens is a ligth red-violet, towards the top almost white with a blue-violet tinge.

The branches are spreading, the angle of the dichotomy being mostly obtuse, though sometimes acute. The joints are long, often reaching a length of more than one cm., cylindrical, and in their upper end, bifurcate, the nodes often (not always) occurring at rather a long distance above the dichotomy, one or sometimes even 2 mm. above it. In the upper end of the frond the dichotomy often does not occur, but the filaments are divided by nodes in a similar way as that found in the ramified parts of the thallus.

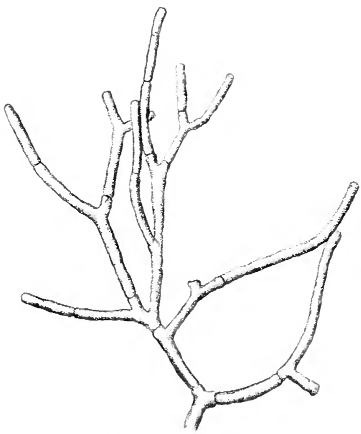

Fig. 172. *Amphiroa rigida* Lamx. var. *Antillana* nov. var. Part of a more irregularly ramified thallus. (About 2 : 1).

Of the illustrations I have seen of this species my plant seems to come nearest to the above mentioned figure of ZANARDINI (Fig. *B* 1), but the ends of the branches of my plant are less tapering and not so curved as the ones in ZANARDINI's figure.

From SOLMS-LAUBACH's description (l. c. p. 7) my plant seems to differ somewhat. He says: "Sie zeichnen sich durch unregelmässige Verzweigung und durch spitzwinklige, wenig divergente Richtung der Aeste aus, daher denn stets kompakte dichte Rasen gebildet werden". As described above

my plant has just a fairly regularly dichotomous ramification, and the angle between the branches is often obtuse.

Judging from YENDO's figure (l. c., pl. IV, fig. 4) the Japanese plant seems also to be more irregularly ramified and to form more compact tufts than the West Indian one.

As to the anatomy I found it agreeing very well with M^me^ WEBER's excellent description. In the joints the central strand consists of two rows of long cells, alternating regularly with one row of short cells. The long cells have a length of about 100 μ, the short ones of about 20 μ only.

Fig. 173. *Amphiroa rigida* Lamx. var. *Antillana* nov. var. Part of the node showing the acute ends of the cells. (About 270 : 1).

The cortical tissue consists of several layers of short cells, shortest at the periphery. In the young thallus the cortex consists only of a few layers of cells, in the older one, on the other hand, of several, because the cortical layer increases, as the plant grows older, in thickness (comp. SOLMS-LAUBACH, l. c.).

As mentioned by this investigator and described more particularly by M^me^ WEBER the nodes of *Amphiroa rigida* consist of two rows of cells (Fig. 173). The cells in these rows are of nearly the same size and have thick walls, except in the upper and lower ends where they meet the cells of the central strand. Here the transverse walls are horizontally placed while the cells in the middle of the node meet each other with oblique walls, being in this way more firmly connected. As suggested by M^me^ WEBER this might, perhaps, help to increase the strength of the node. A good illustration of the node is given by YENDO in "Corallinæ veræ Japonicæ", pl. 1, figs. 5—6.

To judge from HARVEY's description of *Amphiroa fragilissima* in Nereis, part II, p. 85 the plant he has had before him seems to be the same as the present one. HARVEY's description seems in any case quite to agree with my plant; but, in order to settle exactly their identity, an examination of HARVEY's plant is of course necessary. HARVEY's closing remark that it is "an exceedingly fragile species, of which it is almost impossible to preserve more than broken fragments" is also quite in accordance with my plant, this being too very fragile. Most probably this quality has induced HARVEY to refer his plant to *Amph. fragilissima* having not noticed the most

characteristic of this species: the swollen padlike ends of the joints, pointed out very clearly in Linné's short diagnosis which runs[1]): "C. dichotoma, articulis filiformibus divaricatis, apice basique latioribus" and described later on by LAMOUROUX in Hist. d. Polyp. Corallig. flexibl., p. 298 (first quoted by HARVEY) in this way: "articulations cylindriques avec un renflement en forme de boulet à leurs extrémités". In ELLIS and SOLANDER's description of their *Corallina fragilissima* (in Nat. Hist. Zoophytes 1786, p. 123, pl. 21, fig. *d*) this character is not mentioned. Their diagnosis of the species runs verbally: "Corallina dichotoma, articulis cylindricis, æqualibus lævibus ramis erectis". This diagnosis agrees perhaps best with *Amph. rigida* the padlike swollen ends of the joints being not mentioned, but the upper bifurcate ends of the joints characteristic of this species are neither mentioned, and if we examine their figure the nodes except one are drawn at the dichotomy. As an examination of ELLIS and SOLANDER's specimens is not possible, their collections, as mentioned earlier (comp. p. 89), most probably not existing any longer, it seems to me the best course to regard *Amph. fragilissima* and *Amph. rigida* in the sense of LAMOUROUX and this the more so, as LINNE's short, but striking diagnosis of *Corallina fragilissima* does not leave any doubt as to the plant he had before him.

This species has been found only once. It was growing in shallow water between *Cymodocea manatorum* and other seagrasses in a place somewhat sheltered by coral reefs.

St. Croix: Rust up Twist.
Geogr. Distrib.: Mediterranean Sea, West Indies, Japan.

2. **Amphiroa fragilissima** (L.) Lamx.

LAMOUROUX, I. V. F., Histoire des Polypiers corallig. flexibl. vulg. nomm. Zoophytes. Caen 1816, p. 298. ARESCHOUG, I. E., in J. AGARDH, Spec. Alg., vol. 2, pars 1, 1851, p. 531. WEBER- VAN BOSSE, A. and M. FOSLIE, The Corallinaceæ of the Siboga-Expedition, Leiden 1904, p. 89, pl. XVI, figs. 1, 2, 5 (ubi synomyna pluria). KÜTZING, F., Tabulæ Phycologicæ, vol. 8, pl. 39, fig. 1.

Corallina fragilissima L., Systema nat., ed. 12, vol. 1, p. 1305). ELLIS, J. and D. SOLANDER, Zoophytes 1786, p. 123, pl. 21, fig. d? (comp. remarks above).

Amphiroa debilis Kütz., Spec. Algarum, 1849, p. 700. HARVEY, W. H., Nereis Bor.-Am., Part II, 1853, p. 86.

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[1]) LINNÉ, Systema Naturæ. Editio duodecima reformata. Holmiæ 1767. Tom. I, Pars II, p. 1305.

The specimens found seem to agree very well with the description given by M^me^ WEBER and quoted above. The most characteristic feature of this species is that the long cylindrical joints are swollen padlike at both ends in the older parts of the thallus (comp. the fig. *b* of KÜTZING, l. c.).

As pointed out by Mme WEBER the central strand consists of a variable number of rows of long cells, interrupted by one or two rows of short cells. In the specimens examined by me I have found 4—6 rows of long cells, their length varying from about 55—90 μ, that of the short ones from 15 to 30 μ.

The nodes have nearly the same anatomical structure as that found in the joints, only that the walls of the cells are somewhat thicker and not calcified. Mme WEBER has given a very fine illustration of the node (l. c.).

The conceptacles form small, roundish, prominent cushions along the sides of the joints. I have only found tetrasporic plants. The tetrasporangia are about 50 μ long and 25 μ broad and often taper upwards in such a way that the uppermost spore has a conical shape.

Having examined the authentic specimens of *Amphiroa cuspidata* and *A. cyathifera* and having found that their anatomical structure does not differ from that of *Am. fragilissima* Mme WEBER comes to the conclusion that these two species are only forms of the present plant. When stating this Mme Weber adds: "I do not attach great importance to this point, whether specimens are more or less slender, if they agree on all other points". I share this view with Mme WEBER especially as my plants differ much in this respect the varying strength of the plants seeming to originate from the locality in which the plants are found. This is easily illustrated by an example. Specimens found near Cruz Bay, St. Jan, growing in an exposed place where the waves constantly dashed the plants, form very compact, dense tufts; they have comparatively short and thick joints, the diameter of which in the middle of the thallus reaches a length of about 460 μ. On the other hand specimens from sheltered localities and those growing between and protected by sea-grasses are more slender, forming loose and open tufts, with much longer and thinner joints, their diameter reaching only a length of about 190 μ.

This species is very common along the shores of the islands and occurs both in sheltered and exposed localities, in shallow water and in deep sea down to a depth of 10 fathoms or even more. It often grows abundantly upon coral reefs and here,

together with *Jania adhærens* and *Corallina cubensis*, covers large extensions.

It is a favoured refuge of many small algæ which find a comparatively quiet growing place among its rigid filaments. Besides many red algæ, e. g. *Hypnea*, *Spyridia* etc., *Cladophoropsis membranacea* especially settles itself here and often grows so vigorously here that it quite covers the host plant and together with it forms quite thick carpets on the rocks over which the surf constantly breaks. The small forma *reducta* of *Caulerpa racemosa*, mentioned in Vol. I, p. 151 was found in such a locality growing between *Amphiroa fragilissima* and in Fig. 123 in the same volume the var. *occidentalis* of *Caulerpa racemosa* is shown creeping between the densely felted filaments of this alga.

It has been collected with tetraspores in January—March.

Geogr. Distrib.: West Indies, Indian Sea.

Corallina (L.) Lamx.

1. **Corallina cubensis** (Mont.) Kütz. emend.

Kützing, Tabulæ phycologicæ, vol. 8, p. 37, pl. 77, figs. *e*, *f* (non fig. *d*).
Jania cubensis Mont. in Kützing, Species Algarum, 1849, p. 709; Montagne, Sylloge gen. specierumque Cryptogamarum, 1856, p. 429.

Up to the present day this species has been considered a doubtful one and it cannot be denied that the description of Montagne is, indeed, very poor and even misleading.

It is described previously in Kützing's "Species Algarum"; the diagnosis, the same, that is found in Montagne's "Sylloge", 1849, p. 429, reads verbatim: "J. intricata, subsetacea, filiformis, teres, alterne ramosa vel subdichotoma, ramis subpinnatis, pinnis ciliiformibus paucis patentibus subulatis; articulis elongatis, diametro 4—6 plo longioribus, primariis clavatis, pinnarum cylindricis. Alt. 1/2''". — Cuba (v. s.). — "Spec. dedit cl. Montagne", is added by Kützing.

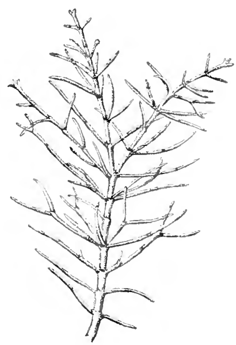

Fig. 174. *Corallina cubensis* (Mont.) Kütz. Habit of a plant. (About 6 : 1).

This description might agree in some points with my specimens, but it disagrees

absolutely with my plant, with its mostly opposite branches, when it is said in the diagnosis: "alterne ramosa vel subdichotoma".

Thus an examination of the original material was highly desirable, and I am greatly indebted to M[me] WEBER for the permission to examine the original material sent by MOMTAGNE to KÜTZING and preserved in his herbarium, now in the possession of M[me] WEBER. This specimen has also a special interest on account of the fact that the only existing illustration of this species, namely that in KÜTZING's "Tabulæ" (l. c.), is based upon it.

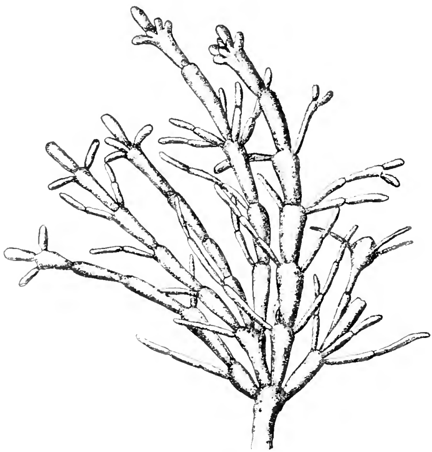

Fig. 175. *Corallina cubensis* (Mont.) Kütz. Upper part of a plant with more or less verticillated branches and a tetrasporic conceptacle. (About 16:1).

After the examination of the material it at once became evident that it was a mixture of two species present in nearly the same quantity, namely a form of the plant which I in a following page call *Jania adhaerens* and another plant, the present one, for which I keep the name *cubensis*. It is interesting to see that KÜTZING very correctly has illustrated both species, his fig. *d* representing *Jania adhaerens* while figs. *e* and *f* are *Corallina cubensis*.

Before entering upon a description of this plant I further want to point out that in my specimens, too, *Jania adhaerens* is often abundantly present. Besides, *Corallina cubensis* also, often grows intertwisted among *Amphiroa fragilissima*.

After these introductory remarks I shall proceed to give a description of the plant based upon my own material.

Corallina cubensis grows upon rocks and corals and forms low dense tufts about 1—2 cm. high, often spreading widely.

The slender filaments are densely crowded, fastigiate and mixed up together. The branches issue as a rule immediately below the nodes (Fig. 174), but the ramification is very irregular.

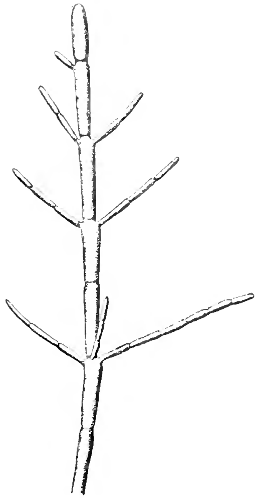

Fig. 176. *Corallina cubensis* (Mont.) Kütz. Summit of a slender plant. (About 18:1).

As a rule it is opposite, but sometimes 3—5 or more verticillated branches are found (Fig. 175, 176). These branches are generally of a very different strength, some being vigorous, others delicate. Now and then too, a single branchlet is issued from each joint or they are quite destitute of branches. And what especially contributes to make the ramification irregular are the many adventitious branches (Fig. 177). These often grow out below the ordinary branches, but they may also issue almost everywhere from the joint e. g., as shown in Fig. 177, from the middle of the joint. Some of the branches, the most vigorous, grow out to main filaments like the mother-branch, but most of them become short branchlets only. These branchlets are undivided, or they may bear a single or a few opposite branches. The branchlets taper evenly upwards to their apex. At their base the branchlets are about 100 μ thick, at their upper end they often scarcely reach 35 μ in diameter. In the main filaments the joints are about 180 μ thick, somewhat thicker in their upper end, thinner in the lower one; their length reaching 600 μ or more.

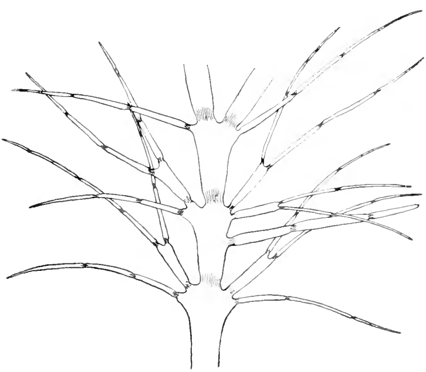

Fig. 177. *Corallina cubensis* (Mont.) Kütz. Joints with adventitious branches. Drawn from a decalcified specimen. (About 18:1).

Once in a specimen I found a few of the branchlets ending in small attachment discs (Fig. 178).

The base of the plant consists of pro-

strate decumbent branches, fastened to the substratum by means of haptera.

As to the anatomy the central strand in the joint commonly consists of 4 rows of cells; these are about $100\,\mu$ long and about $12\,\mu$ broad; the cells in the nodes are almost of the same size, longest in the middle, and growing shorter near the periphery (Fig. 179).

Tetrasporic conceptacles (Fig. 175, 180) have been found now and then. These are urn-shaped and are produced in the upper

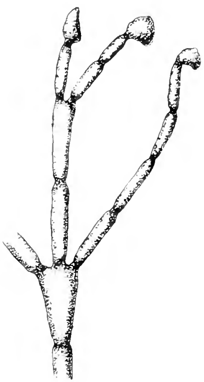

Fig. 178. *Corallina cubensis* (Mont.) Kütz. Branchlets ended with small discs. (About 20:1).

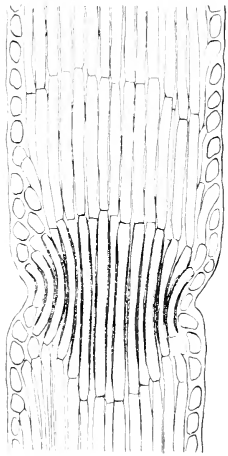

Fig. 179. *Corallina cubensis* (Mont.) Kütz. Longitudinal section of the node. (About 200 : 1).

joint of the branchlet. They are rarely destitute of ramuli (horns), mostly bearing 2—5 ramuli verticillately placed round the middle of the conceptacle. The conceptacles are about $450\,\mu$ long and $270\,\mu$ broad. The tetrasporangia are transversely divided, nearly cylindrical or somewhat curved with rounded ends, about $180\,\mu$ long and $70\,\mu$ broad.

Corallina cubensis seems to be rather common along the shores of the islands; it is found in depths from 5—10 fathoms of water and occurs often in the open sea in places where strong currents prevail. It is generally associated with other corallineous algæ, e. g. *Amphiroa fragilissima* and *Jania adhaerens*.

St. Croix: off Frederiksted, in White Bay. St. Jan: off America Hill and in several places in the sound between this island and St. Thomas.
Geogr. Distrib.: West Indies.

Fig. 180. *Corallina cubensis* (Mont.) Kütz. Transverse section of a tetrasporic conceptacle. (About 80:1).

Jania Lamx.

In various papers Yendo[1]) points out that the most characteristic feature by which *Jania* is distinguished from *Corallina* is the dichotomous ramification of the filaments as against the pinnated branches in *Corallina*. I agree with Yendo in this point of view.

1. Jania pumila Lamx.

Lamouroux, I. V. F., Hist. Polyp. corallig. flexib., 1816, p. 269, pl. 9, fig. 2. Areschoug, I. E. in J. Agardh, Spec. Alg. vol. II, p. 559.

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[1]) Yendo, K., Principle of systematizing Corallinæ (The Botanical Magazine, Tokyo, 1905, vol. XIX, p. 123) and A revised list of Corallinæ (Journal of the College of Science, Tokyo 1905, vol. XX, p. 2).

Corallina pumila (Lamx.) Kütz., Tab. Phycol., p. 39, tab. 83, fig. 1. Hauck, F., Meeresalgen von Puerto-Rico in Engler, Bot. Jahrb., 9. Bd., 1888, p. 465. Heydrich, F., Beiträge zur Kenntnis der Algenflora von Ost-Asien (Hedwigia 1894, p. 301).

This little plant grows epiphytically upon larger algæ, e. g. *Turbinaria* and *Zonaria.* It is fastened to the host-plant by means of a small roundish disc. In the specimens examined by me the disc was about 400 μ in diameter. From the surface of this disc the erect filaments arise; at their base, where they are attached to the disc, a node is always present.

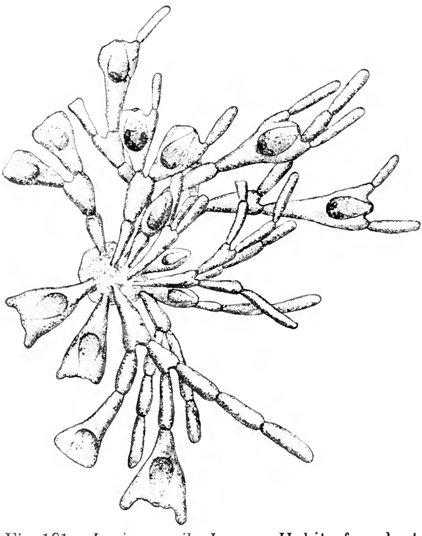

Fig. 181. *Jania pumila* Lamx. Habit of a plant with cystocarpial and antheridial conceptacles growing upon *Turbinaria.* (About 25 : 1).

As the specimens showed some differences according to their growing upon *Turbinaria* or *Zonaria* I wish to describe them separately and begin with those upon *Turbinaria* (Fig. 181). This was growing in a very exposed place at Judith Fancy on the north side of St. Croix and on account of this the specimens of *Jania* had also a rather robust appearance.

The erect filaments are of very variable size and development. Some of them consist of a single joint which on its top bears a conceptacle, others are longer, a few times dichotomously divided, ending in conceptacles, if they are not throughout vegetative.

In the basal part of the filaments the vegetative joints are mostly oblong-cuneate with broadly rounded top and very attenuated base, in the upper part nearly cylindrical, tapering somewhat to both ends. The first mentioned joints are about 200 μ long, about 150 μ broad at their upper end and 70 μ at their base, but much larger ones occur; the more cylindrical joints in

the upper ends of the filaments are about 250 μ long and about 80 μ broad in the middle.

The antheridial and cystocarpic conceptacles occur together in the same plant (Fig. 181), while the tetrasporic conceptacles occur in separate plants.

As pointed out by HAUCK (l. c.) the tetrasporic and female conceptacles are developed in the basal joint in the uppermost dichotomy. This joint is cuneate of shape; it is large, of very variable length, often more than 800 μ long; the breadth, at the upper end, where the conceptacles are found, seems on the other hand less variable, about 250 μ.

Fig. 182. *Jania pumila* Lamx. Longitudinal section of tetrasporic conceptacle of specimen found upon *Turbinaria*. (About 75 : 1).

In the tetrasporic conceptacles (Fig. 182) the hornlike prolongations at both sides of the conceptacles mostly consist of two nearly cylindrical joints, while in the female conceptacles these horns consist only of a single joint. But having seen so very few plants I dare not say that this is always the rule; in the female conceptacle the joints in the horn are about 60—70 μ broad and about 300 μ long, while in the tetrasporic the lowest joint in the horns is about 70 μ broad and 400 μ long, the upper joint a little thinner and shorter, about 230 μ long.

The joint with the antheridial conceptacles are ovate—spindleshaped and of smaller size than the tetrasporic and female conceptacles; they are about 250 μ long and 140 μ broad. They are formed in the uppermost joint of a branch; the few antheridial filaments I have seen in the form from this locality have all been short, consisting only of the antheridial joint or, besides, of a single vegetative joint below.

While I have had very few specimens growing upon *Turbinaria* at my disposal, I have collected a specimen of *Zonaria lobata* at the shores of St. Croix upon which numerous specimens of this small *Jania* were present (Fig. 183). Unfortunately the exact locality of this plant is not known, but most probably it

is from a more sheltered place. Compared with the above described specimens these are comparatively slender with longer branches. The erect filaments are several times dichotomously branched. The antheridial conceptacles occur in the ends of these long branches as against the often sessile ones in the form described above. The tetrasporic conceptacles (Fig. 183) have longer horns consisting of 4 joints; female conceptacles I have not seen.

As to the anatomy, the cells in the central strand are of about the same length as those in the nodes.

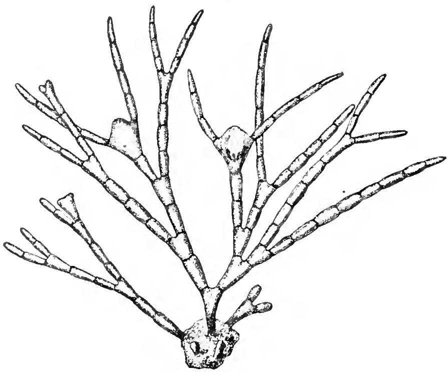

Fig. 183. *Jania pumila* Lamx. Specimen found upon *Zonaria*. (About 20 : 1).

In referring this plant to *Jania pumila* I may point out that I have not been able to make any comparisons with original material; to arrive at an exact determination this seems necessary, the more so, as the original description is very poor and the accompanying figure of no value at all. The form KÜTZING has illustrated differs considerably from my plant. In naming my plant *I. pumila* I rely upon HAUCK's description; this is based upon specimens from Puerto-Rico and seems to agree well with my plant. HAUCK does not mention how far he has compared his plant with original material. The plant from Jamaica distributed in "Phycotheca Bor.-Am.", no. 799 seems to come very near to mine.

This plant has only been collected a few times, but is most probably a common epiphyte upon larger brown algæ.

St. Croix: Judith Fancy (upon *Turbinaria trialata*) and another gathering from the same island without exactly known locality (upon *Zonaria lobata*).

Geogr. Distrib.: West Indies, Red Sea, Indian Ocean, Japan etc.

2. Jania adhaerens Lamx.

Lamouroux, I. V. F., Histoire des polypiers coralligènes flexibl. vulg. nommés Zoophytes, Caen 1816, p. 270. Areschoug, J. E., in J. Agardh, Spec. Alg., vol. II, pars 2, p. 559. Kützing, F., Tab. phycol., vol. 8, pl. 83, figs. *g*, *h*.

The specimens I have referred to this old species of Lamouroux vary considerably with regard to size, length of joints in

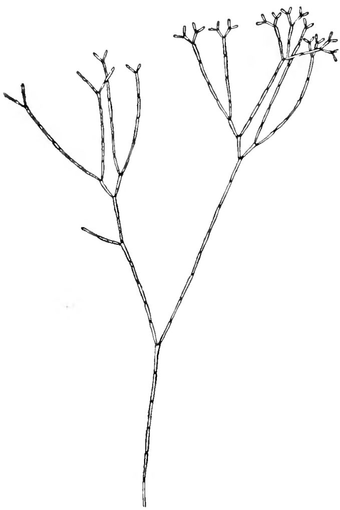

Fig. 184. *Jania adhaerens* Lamx. Habit of a specimen. (About 7:1).

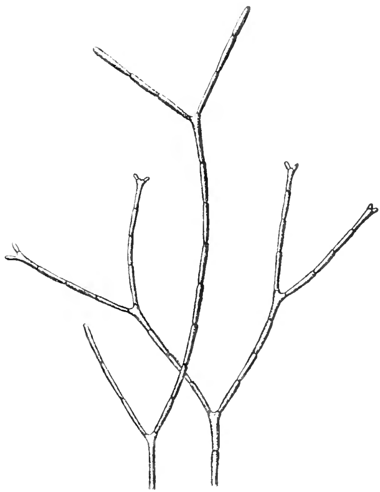

Fig. 185. *Jania adhaerens* Lamx. Upper ends of filaments showing the regular dichotomy. (About 20:1).

proportion to breadth etc., but nevertheless it seems very natural to me to take them together, as transitional links are found between them and they, most probably, are nothing but variations of the same plant due to differences in habitat.

The plant grows upon stones, corals or similar substrata or intertwisted among other *Corallinaceæ*, e. g. *Amphiroa fragilissima* or epiphytically upon larger algæ, especially *Digenia*, stems of *Halimeda*, *Avrainvillea* etc.

When growing upon stones etc. it forms small dense, roundish tufts upto 1—2 cms. high, when epiphytic it often covers the host plants quite densely.

The thallus is slender (Fig. 184). In the basal part of more vigorous plants its diameter reaches about 100 rarely up to 150 μ, upwards it grows thinner and in the uppermost thin filaments the diameter reaches only a length of about 30—60 μ. The thallus is repeatedly dichotomously ramified (Figs. 184—185). At the base of the branches a node is always found. The distance between the ramification is of very variable length, now long and now short, but, when long, the thallus is divided by nodes in nearly equally long joints. The length of the joints varies from 5—8 times their breadth.

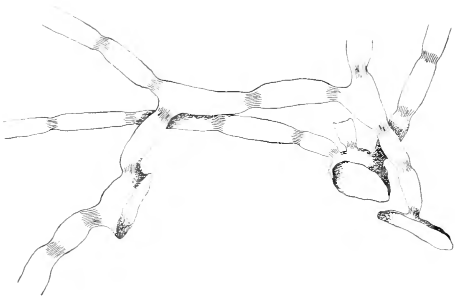

Fig. 186. *Jania adhaerens* Lamx. Basal parts of filaments with flat, roundish attachment discs. (About 60 : 1).

The cells in the nodes are about 200 μ long and 7 μ thick; in the joints 3—5 rows of long cells are mostly found; these have nearly the same length as those found in the nodes.

In the basal parts of the thallus I have found a few times some small attachment discs (Fig. 186); those are mentioned by YENDO in his paper: "Corallinae verae Japonicae (Journ. of the College of Science, vol. 16, part 2, p. 24, Tokyo 1902).

Nearly all the specimens I have come across are sterile; some few tetrasporic specimens were found growing epiphytically upon *Digenia* (Fig. 187). The conceptacles are urnshaped; they are developed from the basal cell in the upper dichotomies and provided with two long branchlets often several times articulated. The conceptacles are about 300 μ long and of nearly the same breadth.

In another specimen growing upon Corals some few conceptacles were also found. These were about 240 μ broad and 340 μ long, and had very long horns.

As mentioned above this plant occurs both upon stones etc. and epiphytically upon larger algæ. It is found both in sheltered

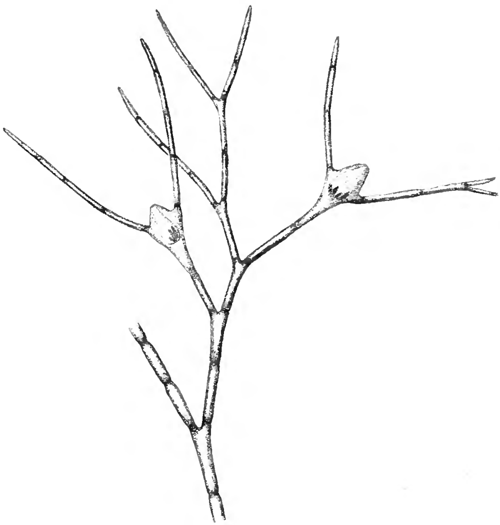

Fig. 187. *Jania adhaerens* Lamx. Specimen with tetrasporic conceptacles. (About 20 : 1).

localities and in more exposed ones, and in shallow as well as in deeper water (about 10 fathoms or more).

It is a very common species along the shores of the islands.

Geogr. Distrib.: Red Sea, Indian Ocean, Japan.

3. **Jania decussato-dichotoma** Yendo.

Yendo, K., A revised list of Corallinæ in Journal of the College of Science, Tokyo 1905, vol. XX, p. 37.

Corallina decussato-dichotoma Yendo, Corallinæ veræ Japonicæ in Journ. of the College of Science. Tokyo 1902, vol. XVI, p. 25, pl. III, figs. 1—3; pl. VII, fig. 34.

Intermingled with other Corallinaceæ, e. g. *Amphiroa fragilissima* and *Corallina cubensis* I have found a few specimens of

a somewhat more robust plant than the aforementioned one. It seems to show much likeness in shape and size to YENDO's species.

In the specimens found the diameter of the joints varies from $110\,\mu$ to $175\,\mu$, their length being 3—5 times as long. The whole plant is rather straight and stiff.

The joints in the filaments are cylindrical, except the uppermost ones in the ends of the filaments which taper much upwards, ending in acute pointed summits.

The specimens found are all sterile. I wish to point out that they show much likeness to the habit-figure of KÜTZING's *Jania tenella* in Tabulæ Phycologicæ. vol. VIII, pl. 85 (fig. *f*), but this species is smaller; in DE-TONI's Sylloge the filaments are said to be $100\,\mu$ broad.

The plant was collected in rather deep water, about 10 fathoms.

St. Jan: off America Hill and in the sound between St. Jan and St. Thomas off Cruz Bay.

Geogr. Distrib.: Japan.

4. Jania capillacea Harv.

HARVEY, W. H., Nereis Boreali-Americana, Part II, 1853, p. 84.

In the Herbarium of the Botanical Museum is found an old specimen of a *Jania* which I think can be considered as a form of HARVEY's plant.

HARVEY's short diagnosis runs verbally: "minute, dichotomous, capillary, with wide axils; branches recurved, squarrose; articulations cylindrical, four to six times as long as broad".

The plant in question (Fig. 188) agrees very well with this diagnosis with the exception that the joints are somewhat shorter in proportion to their breadth, these being about $150\,\mu$ long and 350—$400\,\mu$ broad.

A plant very similar to that from St. Croix has been distributed in Phycotheca Bor. Am., Nr. 150, originating from Jamaica. This plant, too, has comparatively short joints. On the other hand I have seen a small specimen belonging to the Riksmuseum, Stockholm, which seems better to agree with the diagnosis of HARVEY. It was collected at Key West and determined by FARLOW. The filaments in this plant are about $110\,\mu$ thick, the length of the joints about 5 times as long, but this plant approaches considerably to some of the forms I have referred to *Jania adhaerens*.

The specimen from St. Croix had tetrasporic conceptacles; these were developed not only in the uppermost joints below the dichotomy, but also farther down in the plant. Perhaps we in this have a means to distinguish the two plants in question, in any case I have always found the conceptacles in the uppermost joints in the forms I have referred to *Jania adhærens*, but I may point out that I have seen only very few fruiting specimens.

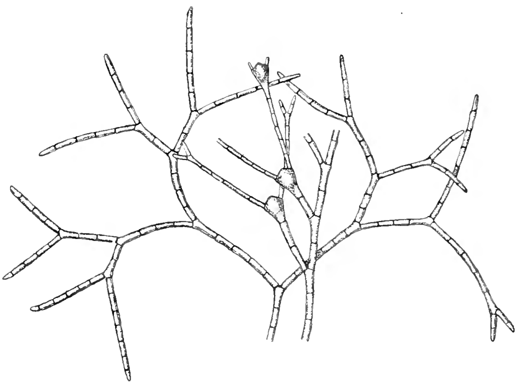

Fig. 188. *Jania capillacea* Harv. Part of a sterile plant and a branch with tetrasporic conceptacles. (About 15 : 1).

Unquestionally *Jania capillacea* comes near to *Jania adhærens.* What especially distinguishes it from this species is the frequently obtuse angles and the arch-shaped, recurved, squarrose filaments.

St. Croix (without locality) Benzon.
Geogr. Distrib.: West Indies.

5. **Jania** spec.

On a reef in the harbour of St. Thomas I have collected a few small sterile pieces of a *Jania* which perhaps are referable to *Jania rubens* (L.) Lamx. They differ from the two preceding species by the tapering of the joints towards the ends, these being not so markedly cylindrical as is the case of these species.

The thicker joints are about 150 μ thick and 2—3 times as long, the thinner about 80—90 μ thick.

III. Ceramiales.

Fam. 1. Ceramiaceæ.

Subfam. 1. Spermothamnieæ.

Spermothamnion Areschoug.

1. **Spermothamnion investiens** (Crouan) Vickers.

VICKERS, A., Liste des Algues marines de la Barbade (Ann. sciences nat., IX. sér., t. I, 1905, p. 64).

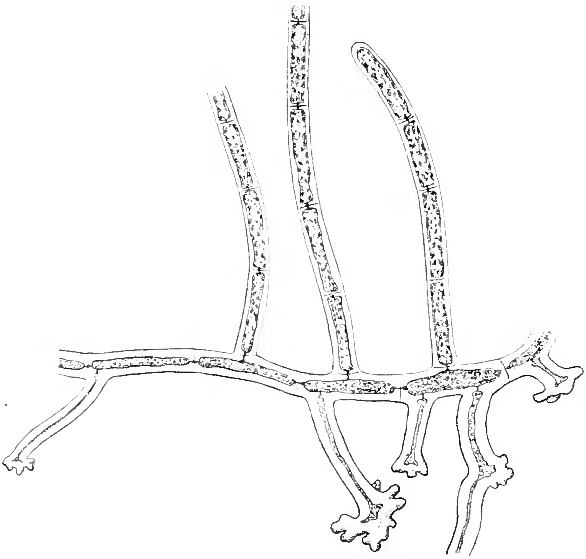

Fig. 189. *Spermothamnion investiens* (Crouan) Vickers var. *cidaricola* Børgs. Base of a plant. (About 175 : 1).

Callithamnion investiens Crouan in A. SCHRAMM et H. MAZÉ, Essai de classification des Algues de la Guadeloupe, Basse-Terre 1865, p. 7.

var. *cidaricola* Borgs.

BØRGESEN, F., Some new or little known West Indian Florideæ (Bot. Tidsskr., vol. 30, 1909, p. 17).

This beautifully purple-rose plant was found upon the pikes of *Eucidaris tribuloides*, often covering these quite densely; the tufts reach a height of $^1/_2$ cm.

The basal creeping filaments (Figs. 189, 190 *A*) are irregularly branched; they are about $30\,\mu$ broad, having a very thick wall (often 8—$10\,\mu$ thick). The filaments are fastened to the pikes of the Echinoderm by means of rhizoids.

These are shorter or longer without any transverse walls, but having very thick peripheral walls, the lumen of the cells is, in this way, reduced to very little. At the bottom end the rhizoids for the most part broaden out to a flat, roundish, irregularly lobed disc.

The erect filaments are very straight and not much branched; the branches issue alternatingly, but seldom oppositely. The filaments are from 16—$25\,\mu$ broad; the cells from 3—5 times as long as the diameter. The last mentioned contain many small, oblong, parietal chromatophores more or less growing together, forming irregularly lobed, parietal plates and having several nuclei especially in the apical cell where often more than ten are to be found. Only plants with tetrasporangia were found. These are situated terminally upon a short one-celled branchlet growing out singly (very rarely in twos) from the upper end of the mother-cell (Fig. 190 *C*). Only seldom the branchlet may have two cells; sometimes, too, it has a lateral stalk-cell with a sporangium (Fig. 190 *B*). The sporangia are tetrahedrally divided, ovate roundish, about 46—$52\,\mu$ long, and 44—$46\,\mu$ broad; the wall of the sporangia is very thick, 6—$8\,\mu$ or more.

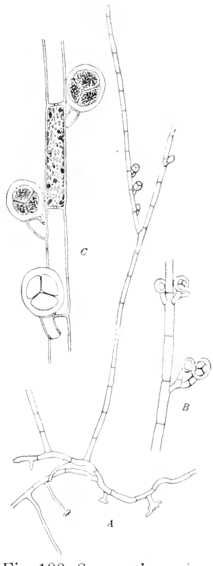

Fig. 190. *Spermothamnion investiens* (Crouan) Vickers, var. *cidaricola* Børgs. *A*, piece of a plant with creeping and erect filaments (25 : 1); *B* and *C*, pieces of erect filaments with tetraspores (*B*, 50 : 1; *C*, 70 : 1).

The original specimens upon which the brothers Crouan have based the description of their species were found upon *Galaxaura lapidescens* and *Strombus gigas*. In Schramm et Mazé, "Essai de classification des Algues de la Guadeloupe" [1])

[1]) During a stay in Paris I saw this rare book in the library of Dr. Bornet, and he allowed me to take a copy of it.

we find the following description: "Frondes filiformes, articulées, monosiphoniées, de couleur rose carmine se conservant parfaitement en herbier" and for the variety: "Fronde filiforme, articulée, monosiphoniée, beaucoup plus longue et plus rigide que l'éspèce type, de coloration rose pâle". These descriptions are very poor, and any exact determination by means of them is excluded. Therefore it has been of much value to me, owing to the kindness of Mr. PAUL HARIOT in Paris, to be able to study an original specimen belonging to the Muséum d'histoire naturelle. This plant, growing upon *Galaxaura*, in nearly every respect agreed with mine. It had the same horizontal, creeping filaments fixed to the host plant with similar rhizoids as in my plant, and from these creeping filaments the erect ones grow up between those of the host plant. But while the erect filaments in my plants are only slightly branched and, as a rule, only in their upper part, the filaments in the type specimen are freely branched from near their base upwards.

As mentioned above my specimens had only tetrasporangia, and this was also the case with all the plants found on specimens of *Eucidaris tribuloides* collected by Dr. TH. MORTENSEN, who most kindly placed his material at my disposal.

This species is found in deeper water only, at a depth of abouth 15 fathoms. It had ripe tetrasporangia in the month of March.

St. Jan: in the sea to the north of this island.
Geogr. Distrib.: West Indies.

Subfam. 2. Griffithsieæ.

Griffithsia C. Ag.

1. **Griffithsia globifera** (Harv.) J. Ag.

AGARDH, J., Epicrisis, 1876, p. 67. DE TONI, Sylloge Algarum, vol. IV, p. 1280. BØRGESEN, F., Some new or little known West Indian Florideæ II (Bot. Tidsskrift, vol. 30, 1910, p. 204).

Griffithsia corallina? var. *globifera* Harvey, Nereis Bor.-Am., part II, p. 228, tab. XXXV A.

Griffithsia globulifera (Harv. in litt.) in KÜTZING, Tabulæ Phycologicæ, 1862, vol. XII, p. 10, tab. 30.

Griffithsia Bornetiana Farlow, The marine Algæ of New England, p. 131, pl. X, fig. 4, pl. XI, figs. 3 and 5.

As to the specific name I refer to my remarks in the paper quoted above.

This species easily known by its characteristic antheridial stands has been found in great quantities in the sea around Buck Island north of St. Croix, and in the sound between St. Thomas and St. Jan. In the North Atlantic it is known from the shores of Massachusetts down to New Jersey. Here it is a summer plant, while in the West Indies it was found by me in February—March.

It is almost certain that it has not been found previously in the West Indies.

To be sure M^lle^ VICKERS records it in her list[1]) of algæ from Barbadoes, but, as pointed out by LEWIS[2]), Professor Farlow does not believe the specimens of M^lle^ VICKERS to be identical with *Gr. Bornetiana.* Moreover Prof. FARLOW himself, most kindly, has informed me by letter that he had written to Dr. BORNET on the subject and, that the latter after having seen the above-mentioned specimens found by M^lle^ VICKERS did not think her warranted in naming them *Gr. globifera.*

In the above quoted paper of LEWIS, edited only

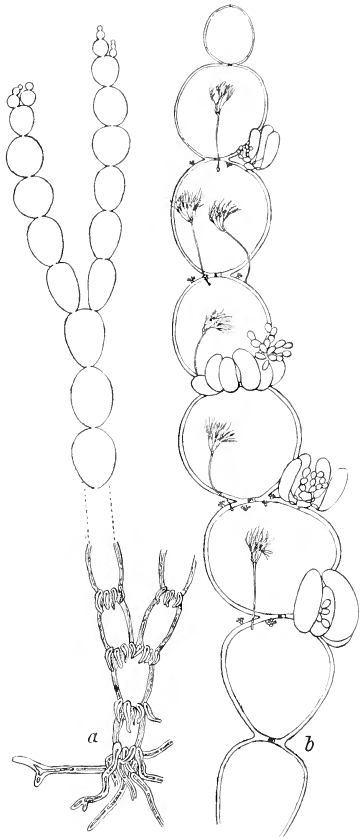

Fig. 191. *Griffithsia globifera* (Harv.) J. Ag. *a*, basal part of a plant and upper end of a branch. *b*, part of a female plant with cystocarps surrounded by protecting cells, verticillate ramified hairs and dwarf shoots.
(*a*, about 6:1; *b*, about 18:1).

[1]) VICKERS, A., Liste des algues marines de la Barbade. (Ann. Sc. Nat. 9e série, Bot. t. I, 1905).

[2]) LEWIS, I. F., The life history of Griffithsia Bornetiana (Annals of Botany, vol. XXIII, nr. XCII, Oct. 1909).

a few years ago, we have got a detailed description of this plant to which I refer, restricting myself here to a short description only and some figures of the West Indian plant, showing its great likeness to and small differences from the North American form. The chief difference is that the cells in the West Indian plants generally are much thicker than those of the plants from the North Atlantic. This applies especially to the cells in the basal part of the thallus. In the West Indian form the cells are nearly oval about 2 mm. long and 1,3 mm. broad, while in the North Atlantic plant the cells are much thinner, but on the other hand much longer, nearly cylindrical with somewhat swollen upper ends. Higher up in the thallus of the West Indian plants the cells are often nearly spherical, of very variable size, the larger about 1,4 mm. broad.

Compared to the sizes given by Lewis, l. c. p. 642, it is evident that the cells of the West Indian form are larger and also seem to have a somewhat different shape from the North Atlantic one, but I do not think we can lay so very much stress upon this fact, and Professor Farlow has also most kindly informed me that the shape and size of the North American plant vary very much, especially in the tetrasporic and sterile specimens, and as my plant, on the other hand, in its tetraspores, antheridia and cystocarps, seems to agree completely with the description of that from the United States I have referred it without any doubt to this species.

The West Indian plant forms dense, semiglobular tufts, reaching a height of 6 cms. or more. It grows especially epiphytically upon calcareous algæ, e. g. *Halimeda*, *Penicillus* etc., but is also found upon stones and pieces of coral at the bottom of the sea. The plant is fastened to the substratum by means of vigorous rhizoids (Fig. 191 *a*)[1]. These grow out from the basal cells, having very thick walls and being very irregularly ramified. Also from the basal end of the cells in the lowest part of the plant rhizoids grow out, but they are shorter here and not ramified. They grow downwards, attaching themselves to the upper end of the cell below, contributing in this way to the strengthening of the whole thallus (Fig. 191 *a*). The wall of the cells in the basal part are very thick and stratified.

The thallus is repeatedly forked (Fig. 191 *a*) and, judging from the young stages of division I have seen, the division

[1]) Lewis, J. c. p. 653 points out that *Griffithsia* is anchored to the substratum either by a special attaching disc, or by a tangled mass of rhizoids.

often comes very near to true dichotomy, but when examined more carefully one finds that one of the young cells is always formed a little earlier and is larger than the other (comp. Fig. 192 *c*, *d*). Lewis, too, (l. c. p. 250) considers the ramification to be lateral, "true dichotomy appears never to occur". In *Griffithsia corallina* Kylin[1]) found the ramification to be lateral, and Oltmanns says in Handbuch the same for *Griffithsia* on the whole.

As pointed out by Lewis, and according to my material also, by far the greater part of the specimens were tetrasporic. The tetrasporangia form a ring at the upper end of the cell (Fig. 192 *a*). As a rule three of them are found together, one of them placed terminally, the others laterally upon a basal cell (Fig. 193 *a*, *d*); the development of this tetrasporic branch is given by Lewis.

On the outside this tetrasporic ring is protected by a circle of short, thick somewhat inwardly curved cells, together forming a kind of involucrum (Fig. 192 *a*). As pointed out by Lewis these cells grow up immediately from the cells in the main filaments (Fig. 193 *a*). In *Griffithsia corallina* Kylin (l. c., p. 116), on the other hand, describes and beautifully delineates the protecting cells as excrescences from the basal cell in the tetrasporic branch. A cell is cut off from the basal cell, and this cell is divided into two cells, the uppermost being very enlarged and becoming a protecting cell. This way

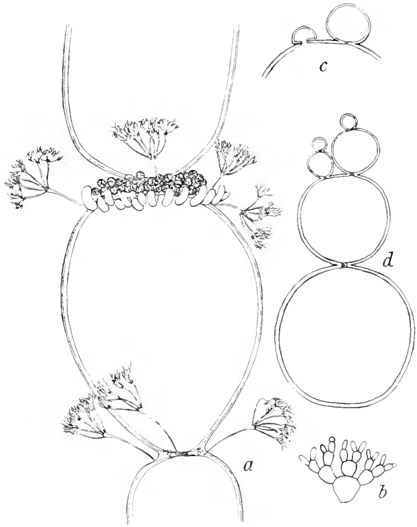

Fig. 192. *Griffithsia globifera* (Harv.) J. Ag. *a*, part of a tetrasporic plant. *b*, a dwarf shoot. *c* and *d*, upper ends of main filaments showing ramification. (*a*, about 25 : 1; *b*, about 250 : 1); *c* and *d*, about 30 : 1).

[1]) Kylin, H., Die Entwicklungsgeschichte von Griffithsia corallina (Lightf.) Ag. (Zeitschr. f. Botanik, 8. Jahrg., 1916, p. 99).

of development being rather different from what is the case in *Griffithsia globifera* I again examined my material, and I found that it verified the observation made by LEWIS. Fig. 193 *b* and *c* shows two young protecting cells. They grow out from the mother-cell in a precisely similar method to the basal cells in the tetrasporic branch. LEWIS describes it in this way (l. c.,

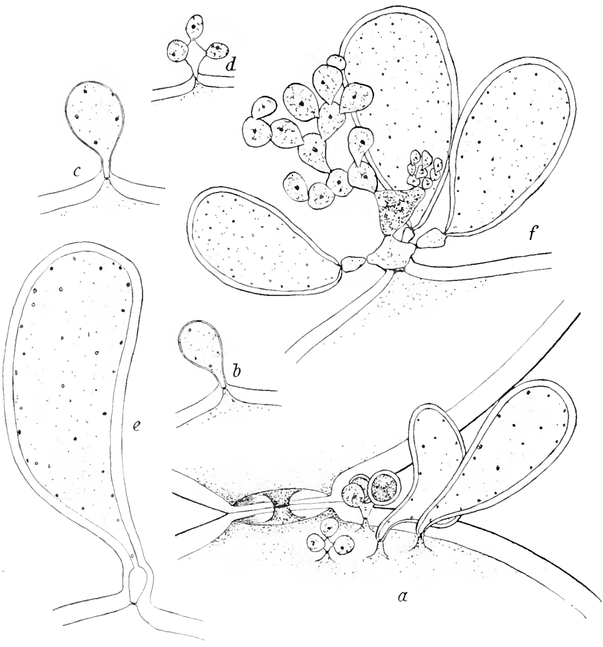

Fig. 193. *Griffithsia globifera* (Harv.) J. Ag. *a*, base and top of two cells of tetrasporic plant showing the large porus; upon the lowermost cell two tetrasporic branches and two involucral cells. *b* and *c*, young involucral cells. *e*, involucral cell with swollen base. *d*, young tetrasporic branch. *f*, young cystocarp with involucral cells. (*a*, about 80 : 1, *b*—*f*, about 150: 1).

p. 664): "On the side toward the stalk-cell the cytoplasm of the mother-cell is produced into a rather narrow strand, which meets a similar strand from the stalk-cell at the point where the callus-like plugs are developed". A few times I have found the basal narrow strand somewhat swollen (Fig. 193 *e*), but I have

not seen any wall or pore so it is evidently nothing else but an accidental swelling.

According to KYLIN's detailed examination of *Gr. corallina* the present species, with regard to the development of the procarp etc., differs somewhat from *Gr. corallina* making a revision desirable. As pointed out by KYLIN the chief difference is that the cell supporting the carpogonial branch in *Gr. corallina* cuts off another cell, this being the auxiliary one, while in *Gr. globifera* no such cell is cut off, the supporting cell itself acting as the auxiliary cell. Unfortunately my material is now unfit for more detailed examination having been kept in formalin for more than ten years, but my figure of the procarp, published in 1910 (l. c., fig. 20 *E*), seems to agree precisely with the figures in LEWIS's treatise and seems to verify his description. But, of course, an examination of fresh material would be desirable.

Fig. 193 *f* shows a young cystocarp in which the peculiar fusion of the cells in the centre of the female branchlet has taken place. From the large placental cell, resulting from this fusion, two sporogenous lobes are developed. The figure shows the involucral cells as the enlarged end-cells of the two-celled branchlets issued from the basal cell in the procarp.

Before the examination of LEWIS the development of the cystocarp in *Griffithsia globifera* has been examined by FARLOW (l. c.), SPALDING[1]) and Miss A. SMITH[2]).

Fig. 20 *D* in my earlier description of the plant shows one of the large terminal cells of the male plant with the characteristic cap-like disc of antheridia at the summit of the cell. FARLOW is the first who has described it and given a figure of it; later it has also been mentioned by LEWIS.

In the West Indies I have found this species fully developed with tetraspores, antheridia and cystocarps in the months of February and March.

All the specimens were collected in rather deep sea in depths from 5—15 fathoms with the exception of a single specimen gathered during my first visit to the West Indies in 1892. It was found in the environs of Christiansted, St. Croix, most probably washed ashore.

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1) SPALDING, V. M., Development of the sporocarp of Griffithsia Bornetiana (Proced. Am. Assoc. Adv. Science 39; 1890).

2) SMITH, A. A., The development of the cystocarp of Griffithsia Bornetiana. Bot. Gazette, XXII 1896.

This species has been found near Buch Island at St. Croix in a depth of about 5 fathoms and in several places in the sound between St. Jan and St. Thomas.

Geogr. Distrib.: The Atlantic coast of North America.

4. **Griffithsia** spec.

A single specimen of a sterile plant, which I suppose to be a *Griffithsia*, has been dredged in the sound between St. Thomas and St. Jan, off Cruz Bay.

The thallus of this plant is repeatedly pseudodichotomously ramified, and has in the basal part large, nearly cylindrical cells, about 300—400 μ thick and 7—8 times as long. Towards the summit the filaments taper gradually, the cells at the same time becoming shorter; the uppermost cells are only about 150 μ thick, the top cell, when more developed, about 100 μ only.

It was found in a depth of about 20 meters.

Subfam. 3. Mesothamnieæ.

Mesothamnion nov. gen.

Habitus frondis omnino *Callithamnio* similis, tetrasporangiis etiam eodem modo dispositis et divisis; differt autem ab hoc genere corpusculis antheridiorum subcylindricis pedicellatisque et procarpiis terminalibus cellulis auxiliaribus singulis instructis.

Cystocarpia ex corpusculis 5—6 subglobosis, carposporas continentibus, composita, ramulis pluribus plus minusve involucrata.

Mesothamnion caribaeum nov. spec.

Planta in parte basali rhizoideis numerosis ramosis affixa; caule non corticato quoqueversum lateraliter ramoso, cellulis fere cylindricis in media parte ca. 450 μ longis, 230 μ latis. Rami eodem modo ramulos gerunt, ramulis pseudodichotomis ex cellulis cylindricis in media parte ca. 80 μ longis, 25 μ latis compositis. Tetrasporangia sphærica triangule divisa, 45 μ lata.

Corpuscula antheridiorum subcylindrica, pedicellata, ca. 75 μ longa, 40 μ lata. Cystocarpia satis magna ex pluribus corpusculis plus minusve sphæricis et magnitudine diversis composita sunt.

The thallus grows like a small shrublike tuft about 2 cm. high. It is fastened to the host plant by means of a very ramified root-system (Fig. 194 *d*). This consists, not only of the basal ramified end of the main filament, but also of several vigorous

filaments emerging higher up from the main stem. Like the main stem these filaments end in rhizoids often growing together to small discs.

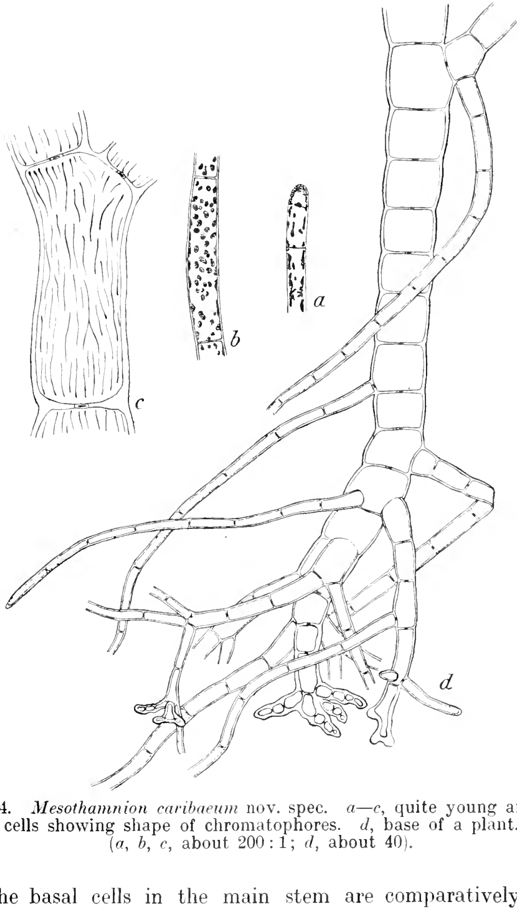

Fig. 194. *Mesothamnion caribaeum* nov. spec. *a—c*, quite young and older cells showing shape of chromatophores. *d*, base of a plant. (*a*, *b*, *c*, about 200 : 1; *d*, about 40).

The basal cells in the main stem are comparatively small, but they rapidly increase in size, so that, at a short distance from the base, we find the thickest part of the main stem, the cells here reaching a breadth of 250 μ or even more; on the other

hand, the cells in this part of the stem are mostly short ones, often reaching only a length of about 100 μ. From this place the cells gradually taper upwards, becoming at the same time longer. In the middle of a plant the cells are about 450 μ long and 230 μ broad; they are nearly cylindrical, yet somewhat swol-

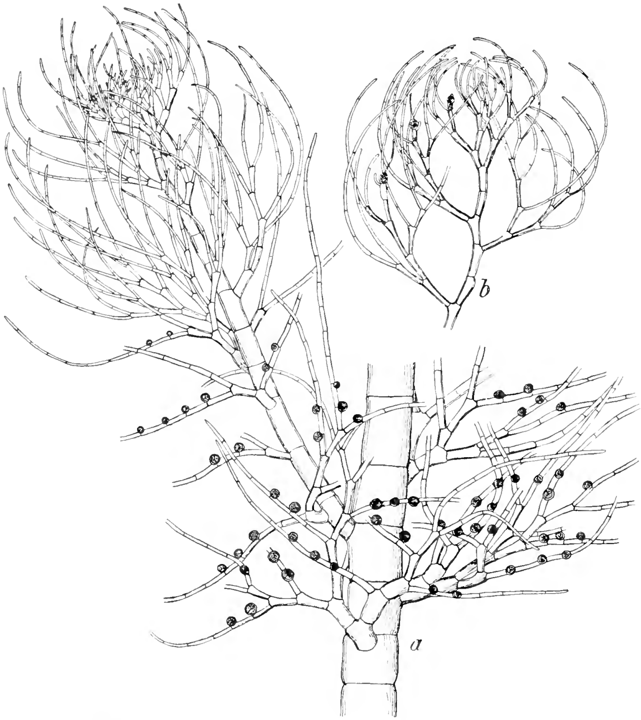

Fig. 195. *Mesothamnion caribaeum* nov. spec. *a*, part of tetrasporic plant. *b*, part of a female plant. (*a*, about 40 : 1; *b*, about 50 : 1).

len at the base, tapering upwards and again a little thicker at their upper end.

Near the summit of a branch in active growth the cells in the main filaments are almost quadratic, about 15 μ broad. In some plants a main stem can be followed through the whole length of

the plant, in others this is not the case as several branches are nearly equally vigorous.

No cortical layer is found, but from the basal cells of the more vigorous branches a rhizoid-like filament often emerges (Fig. 194 *d*), growing downwards along the main stem, but generally not attached to it. In the lowermost part of the plant, as mentioned above, these rhizoids reach down to the host plant and fasten themselves to it, but higher up it may happen that they attach themselves to a branch beneath them.

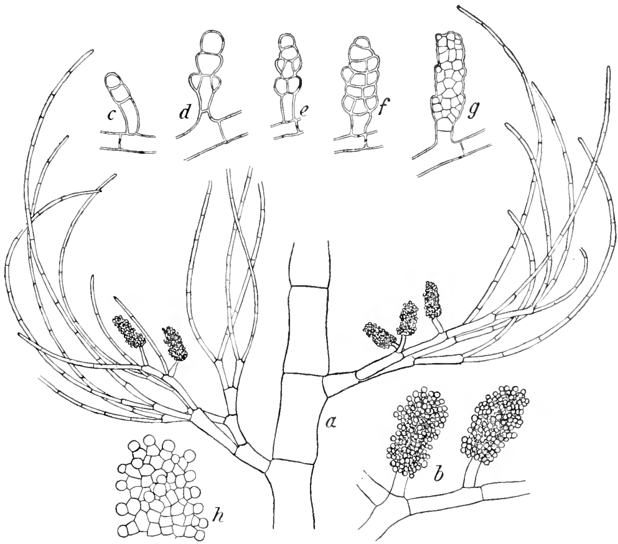

Fig. 196. *Mesothamnion caribaeum* nov. spec. *a*, part of an antheridial plant. *b*, antherial stands. *c—h*, development of antheridial stand. (*a*, about 50 : 1; *b*, about 125 : 1; *c—g*, about 300 : 1; *h*, about 450 : 1).

The plant is much ramified (Fig. 195), the branches issuing multilaterally to all sides. As mentioned above some of the branches grow out vigorously like the main stem, but most of them are not so much developed. These smaller branches are in the same way multilaterally ramified, bearing repeatedly pseudo-dichotomously ramified branchlets on all sides. The branchlets are longest at the base of the branches, higher up shorter and at the same time bent upwards, the whole branch in this way

often getting a penicilliform appearance. The cells in these branchlets are nearly cylindrical, being in the middle of the branchlet about 80 μ long and 25 μ broad.

The chromatophores (Fig. 194 *a*, *b*, *c*) are parietal, consisting, in the quite young cells, of shorter or longer irregularly shaped plates; in more developed cells they have the shape of a small roundish disc and finally in the old mature cells we find them like the thin, sinuate ribbons generally found in this group of algæ.

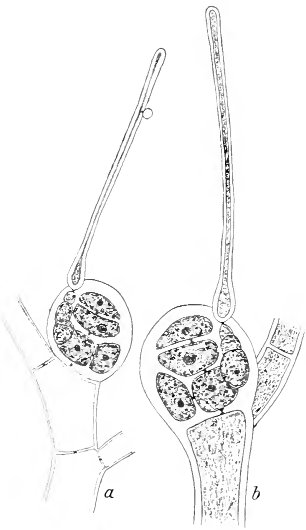

Fig. 197. *Mesothamnion caribaeum* nov. spec. Two procarps with trichogynes. *a*, with adherent spermatium. (About 200 : 1).

One nucleus is present in each cell. Hairs are wanting; at least I have not found any in my material.

Male (Fig. 196) and female (Fig. 195 *b*) plants as well as tetrasporic plants (Fig. 195 *a*) occurred in the collection. Judging by the rather scarce material at hand the tetrasporic and the female plants are the most vigorously developed and also most common, while the antheridial plants seem to be more slender and rare.

The tetrasporangia (Fig. 195 *a*) are spherical, lining the upper (inner) side of the filaments in the branchlets, issuing singly at the upper end of each joint. They are tetrahedrally divided. Their diameter reaches a length of about 45 μ; their wall is about 2,5 μ thick.

The antheridial stands (Fig. 196) are pedicellate, subcylindrical bodies about 75 μ long and 40 μ broad; the stalk is about 30 μ long and 12 μ broad. They are found in the same places as the tetrasporangia, lining the upper side of the filaments. They originate from a cell which is richly filled with protoplasm. This cell is divided by transverse walls into 3—4 superposed cells (Fig. 196 *c*). These increase in size and, with the exception of the lower part of the basal cell which forms the stalk, are divided gradually by several anticlinal and periclinal or more

irregularly arranged walls in a number of small cells or rather short filaments, the end cells of which are the antheridia (Figs. 196 *d—h*).

The procarp occurs terminally upon short branchlets (Fig. 195 *b*). When fully developed it (Fig. 197) consists of a basal cell from which the carpogonial branch issues, and a sterile cell nearly opposite to it; in the middle we find the large auxiliary cell and above it a sterile apical cell. The carpogonial branch is composed of 3 cells and the carpogonium with the trichogyne; the last mentioned is rather robust, nearly cylindrical and very persistent. By means of staining in Mayer's hæmalum I have been able to see the nucleus clearly as well in the auxiliary cell as in the other ones of the procarp except in the carpogonium, this most probably being due to the bad preservation of the material, this having been kept in rather weak spirit.

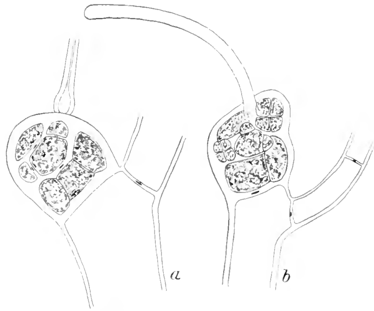

Fig. 198. *Mesothamnion caribaeum* nov. spec. Development of cystocarps. *a*, the auxiliary cell is divided in three cells. *b*, more advanced stage. (About 200 : 1).

After the fertilization the auxiliary cell increases in size, and soon two cells are cut off, one at both ends of it (Fig. 198 *a*). These cells again are divided into smaller ones (Fig. 198 *b*).

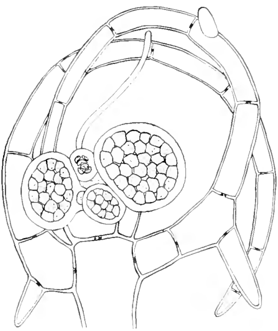

Fig. 199. *Mesothamnion caribaeum* nov. spec. Young cystocarp, the trichogyne is yet present. (About 120 : 1).

Not having had sufficient material I have not been able to follow the development in detail, but the result of the further growth is that we get a large cystocarp composed of several larger and smaller roundish bodies consisting of the numerous carpospores (Figs. 199 and 200). Of these bodies the two on each side are the largest; so far I have been able to follow

the evolution these originate from the two cells firstly cut off from the auxiliary cell. But besides these two larger balls several of variable size are present, these most probably originating from divisions of the cell found in the middle after the division of the auxiliary cell.

Immediately after the fertilization several filaments begin to grow out from the upper end of the cell which carries the procarp. These filaments are branched several times and surround the cystocarp forming in this way a kind of involucrum round it (Figs. 199 and 200).

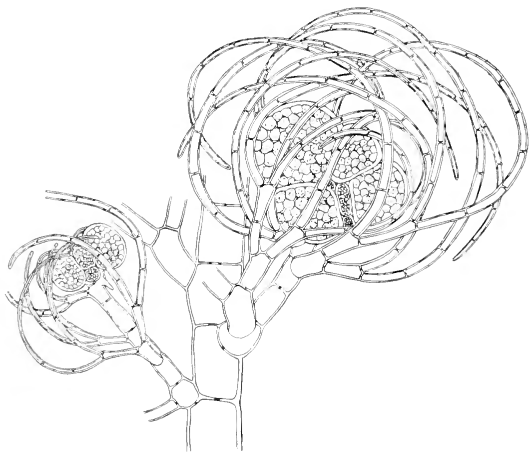

Fig. 200. *Mesothamnion caribaeum* nov. spec. Nearly ripe cystocarp. (About 40 : 1).

If we now seek as to which of the other genera belonging to the *Ceramiaceæ* our plant is most closely related it is evident from the description and figures above that, in the vegetative formation of the thallus, it comes very near to *Callithamnion*. The base of the plant, the ramification of the thallus, the chromatophores and the habit of the thallus on the whole agree perfectly well with that genus and the distribution of the tetrasporangia, too, is quite the same as that found in *Callithamnion*. On the other hand, with regard to the antheridial stands and especially the building of the procarp and cystocarp, it differs decidedly from that genus. As to these organs it seems to me that we

find the most closely related forms in the group of *Spermothamnieæ*. In this group, as in the case of our plant, the procarp is terminally placed and after the fertilization the cystocarp is more or less covered by filaments in a similar way as in our plant. Judging by the figure of *Ptilothamnion Pluma* given by BORNET[1]) the procarp in this plant seems to be exactly like that in the present one. In other genera, e. g. *Spermothamnion* we have two auxiliary cells; but, if we consider the halfpart to the right of the schematic figure of the procarp of this genus given by OLTMANNS' in Handbuch, p. 705, it is easily seen that this is exactly like the procarp in our plant.

As to the antheridial stands these, too, show likeness to those found in the same group; comp., e. g., the figure 2 of *Spermothamnion flabellatum* Born. given by BORNET et THURET, l. c., pl. 8. Closely resembling the antheridial stands of our plant are those found in *Antithamnion Plumula* judging from the figure of BUFFHAM[2]). Much alike too, are, the antheridial stands of *Compsothamnion gracillimum* as represented by the same author[3]). In *Callithamnion*, on the other hand, the antheridial stands mostly form small cushions like those I have described and figured for *Callithamnion cordatum*; for *Callithamnion byssoides* BUFFHAM has figured (l. c., 1884, pl. X, fig. 5) the antheridial stands of this plant, these showing very great likeness to the present one, but the West Indian specimens of *C. byssoides* found by me had the low, cushion-like, antheridial stands commonly found in *Callithamnion.*

In ENGLER und PRANTL, Die Natürl. Pflanzenfamilien, I. Teil, Abt. 2 the Fam. *Ceramiaceæ* is divided in 15 groups; it seems to me on account of the above mentioned facts that our plant must be considered as the representative of a new group: *Mesothamnieæ* forming an intermediate link between the groups *Callithamnieæ* and *Spermothamnieæ*.

M^lle VICKERS in her "Liste des Algues mar. de la Barbade" (Ann. sc. nat. Bot. 1905, p. 65) mentions a "*Callithamnion*? sp. nov.? A des anthéridies cylindriques, comme les *Pleonosporium*, mais les sporanges ne renferment que quatre spores en tetraèdres.

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[1]) BORNET, E. et G. THURET, Notes algologiques, p. 179, pl. 46, fig. 1.

[2]) BUFFHAM, T. H., Notes on the Florideæ and on some newly-found Antheridia (Journ. Queckett Microscop. Club, vol. I, Ser. II, 1884, pl. XI, fig. 2).

[3]) BUFFHAM, T. H., Notes on some Florideæ (Journ. Queckett Microscop. Club, vol. VI, ser. II, 1896, pl. X, fig. 12—13).

Je n'ai pas vu de cystocarpes". Perhaps she has had the present plant before her.

The plant was dredged in deep water in a depth of about 30 meters.

St. Jan: Off Annaberg.

Subfam. 4. Callithamnieæ.

Callithamnion Lyngb.

1. **Callithamnion cordatum** Børgs.

Børgesen, F., Some new or little known West Indian Florideæ (Bot. Tidsskrift, vol. 30, 1909, p. 10).

This plant is an epiphyte forming small, rosy, shrub-like tufts upon the host plant.

It is not corticated; however, from the basal cells of the vigorous branches in the lower-most part of the thallus a single long rhizoid is often developed. It grows downwards along the wall of the large cells in the main stem (Fig. 201). These rhizoids are composed of nearly cylindrical cells about 150 μ long and 25 μ broad.

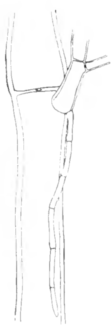

Fig. 201. *Callithamnion cordatum* Børgs. Rhizoid growing out from base of a branch. (About 170 : 1).

The frond reaches a height from 2—4 cm.; the main stem is at the bottom part nearly straight with few branches, becoming more flexuous and richly ramified higher up; near the top the main axis disappears (Fig. 202).

The base (Fig. 203 *A*) consists of short cells, their walls often reaching a thickness of 18 μ or more, the diameter of the whole cell measuring about 200 μ. From the cells near the base rhizoids grow downwards and assist in fixing the plant.

Higher up in the main stems the cells grow longer becoming at the same time thinner, at first twice as long as broad (long. cell. = 300 μ; lat. cell. = 160 μ), and then nearer the top 5—8 times as long as broad (long. cell. = 400 μ; lat. cell. = 50 μ). The uppermost branches are much thinner, only 8 μ thick; they are often arch-shaped and bent inwardly (Fig. 204).

The ramification is alternate, in the upper part subdichotomous.

In my previous description I have said that hairs, as a rule, are absent; this is the case, too, in the older part of the thallus

where hairs seldom occur. On the other hand, in the young summits of the plant being in active growth I have now by a renewed examination of the plant found hairs in the ends of the filaments. The hairs are about $3\,\mu$ broad and $150\,\mu$ long.

The sporangia are obovate-oblong, tetrahedrally divided (Fig. 203 *C*, *D*); they are sessile and occur on the uppermost and inward side of the

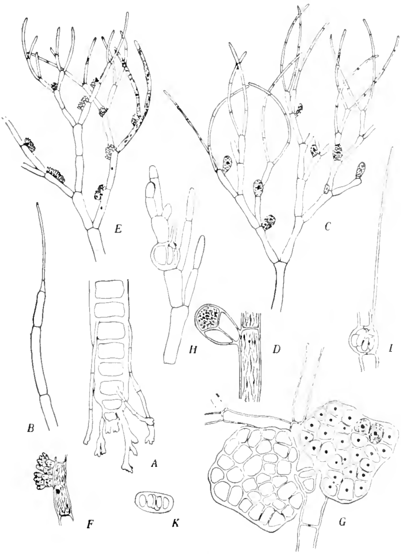

Fig. 203. *Callithamnion cordatum* Borgs. *A*, base of a plant (25 : 1). *B*, end of filament with hair (100 : 1). *C*, part of tetrasporic plant (50 : 1). *D*, tetraspore (150 : 1). *E*, part of antheridial plant (60 : 1). *F*, cell with antheridial stand (150 : 1). *G*, cystocarp (60 : 1). *H*, young procarp (150 : 1). *I*, older procarp with fully developed trichogyne (150 : 1). *K*, transverse section of a cystocarp (60 : 1).

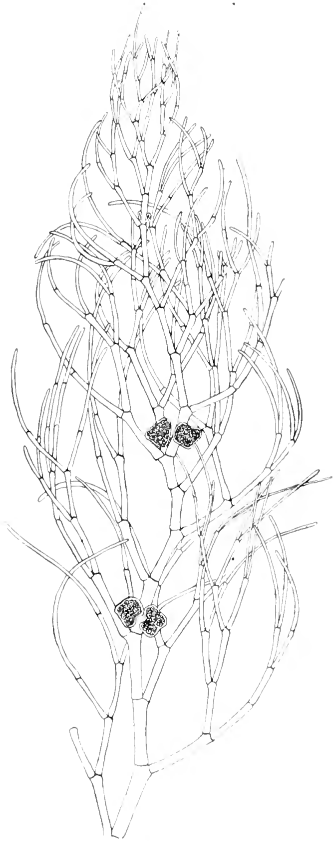

Fig. 202. *Callithamnion cordatum* Borgs. Habit of a female plant. (About 60 : 1).

mother-cell. They are found in special individuals, but a few scattered tetrasporangia can also occur in the female plants (Fig. 204). The tetrasporangia are about $40\,\mu$ long and $27\,\mu$ broad.

The antheridial stands (Fig. 203 *E*, *F*) are found at the same places as the tetrasporangia; they consist of a system of closely placed, short branches, of which each bears 2—4 antheridia.

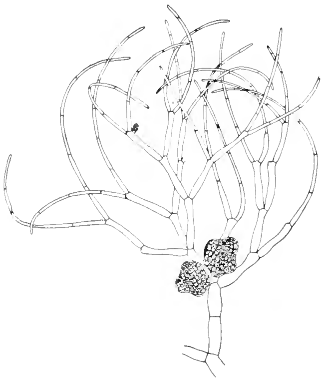

Fig. 204. *Callithamnion cordatum* Borgs. Branch with cystocarps and a single tetrasporangium (50 : 1).

The cystocarps (Figs. 202, 203 *G*, 204) are binate and trilobed heart-shaped, sometimes also more irregularly formed. The younger and smaller ones consist only of a single layer of carpospores (Fig. 203 *K*), but in the bigger cystocarps and especially in the more irregularly shaped several layers are also present.

The carpogonial branch is four-celled and possesses a very long trichogyne (Fig. 203 *I*).

The plant occurred as a common epiphyte on *Gracilaria Blodgetti* and was found only in deeper water (about 15 fathoms). It was collected with tetraspores, antheridia and cystocarps in the month of March.

Occurred in many places in the sound between St. Thomas and St. Jan: off Cruz Bay.

Geogr. Distrib.: Hitherto found only in the above mentioned locality.

2. Callithamnion byssoides Arn.

Arnott in Hooker, English Flora, vol. II, part 1, 1833, p. 342 (Algæ by Harvey). Harvey, Manual, 1849, p. 178; Phycol. Brit. pl. 262. Areschough, I. E., Phyceae Scandin. Marinae, 1850, p. 107, pl. V, B. Cfr. Schmitz, Fr., in Berichte d. deutsch. bot. Ges., Bd. XI, 1893, p. 280. Børgesen, F., Some new or little known West Indian Florideæ (Bot. Tidsskr., vol. 30, 1909, p. 11).

Regarding a comparison of the West Indian form with plants from other countries I refer to my remarks, l. c. Here I shall restrict myself to give a short description only of the West Indian plant (Fig. 205).

It has a rather vigorous main stem whose cells are about 3—4 times as long as broad (lat. cell. = 140 μ); higher up the cells grow thinner and thinner, the youngest tips of the branches being only 9—10 μ thick. The branches emerge spirally from the

main stem; below, the side-branches grow out to long filaments like the main stem; higher up they are shorter; in the uppermost part the ramification is subdichotomous. The plant is not corticated and hairs do not occur.

The tetrasporangia are generally tetrahedrally divided, though cruciately divided ones occur too (Fig. 206 *A*). They are sessile, oblique-obovate or nearly roundish when ripe and 35—40 μ broad.

The cystocarps are, when fully developed, irregularly lobed, binate. I have only found a few procarps; from these it seems evident that the carpogonial branch is four-celled; the carpogonium has a rather long trichogyne (Fig. 206 *C*).

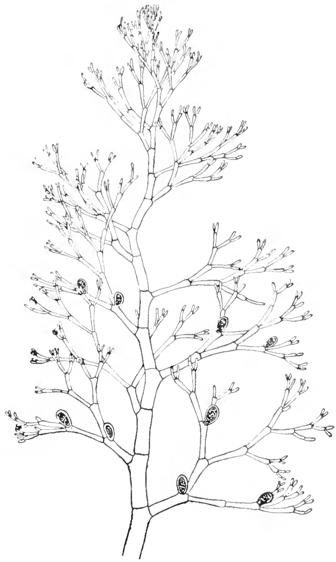
Fig. 205. *Callithamnion byssoides* Arn. Part of a tetrasporic plant. (About 60 : 1).

Antheridial plants had not been seen when I previously examined the plant; these have now been found by renewed examination (Fig. 207). The antheridial stands occur in the same places as the tetrasporangia, lining the upper (inner) side of the filaments. Often they are found only at the summit of the cells, sometimes they occupy nearly the whole upper side of these. They consist of a system of short branchlets in which the uppermost cells are the antheridia. The antheridial stands in the West Indian plant differ rather much from those figured by BUFFHAM[1]). In his specimens these have a single short axis while in the West Indian plant, as mentioned above, the antheridial stand is composed of several short branchlets.

The tetrasporangia, cystocarps and antheridia occur in separate plants.

The chromatophores are parietal and consist of shorter or

[1]) BUFFHAM, T. H., Notes on the Florideæ and on some newly-found Antheridia (Journ. of the Queckett Microsc. Club, vol. I, Ser. II, 1884, p. 341, pl. X, figs. 4, 5).

longer, in the young cells rather broad (Fig. 206 *B*), in the older cells narrower, irregularly sinuate ribbons (Fig. 206 *F*). Each cell

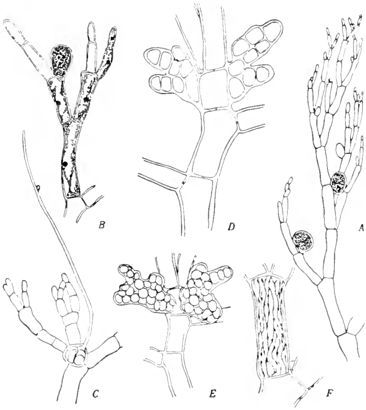

Fig. 206. *Callithamnion byssoides* Arn.
A, *B*, branches with tetraspores (75 : 1), (150 : 1). *C*, carpogonial branch with trichogyne (160 : 1). *D*, young cystocarp (160 : 1). *E*, older cystocarp (75 : 1). *F*, cell with chromatophore (75 : 1).

contains a single nucleus (Fig. 206 *B*), but I wish to point out that I have not succeeded in seeing the nucleus in the older and larger cells.

The plant was found with cystocarps, antheridia and tetrasporangia in the months of January and February. It occurred in shallow water, in a sheltered place upon the roots of the mangroves or upon other algæ growing here.

St. Croix: The Lagoon of Christiansted.

Geogr. Distrib.: Atlantic coast of Europe and North Africa, Mediterranean Sea, Atlantic coast of North America, West Indies etc.

Fig. 207. *Callithamnion byssoides* Arn. Antheridial stand. (About 350 : 1).

3. Callithamnion spec.

This plant being quite sterile (only once a specimen was found with a few nearly ripe tetrasporangia) I have not been able to determine it exactly, but as it was found abundantly in some places in deep water I just want to give a short description of it and a few figures too (Fig. 208).

The plant grows epiphytically upon larger algæ, e. g. *Halimeda*, *Udotea*, *Avrainvillea* and forms entangled masses together with *Cladophora crispula*, *Cladophoropsis* etc. It is fastened to the host plants by means of rhizoids growing out from the cells in the main filaments, often rather high up in the plants (Fig. 208 *b*); the primary base I have not seen. The rhizoids end in small, irregularly shaped discs.

The plant has no cortical layer. The cells in the main filaments are nearly cylindrical about 2,5 mm. long and 400 μ broad. The ramification is multilateral or alternate, in the upper part of the thallus often secund. A few of the branches grow out as filaments like the main filaments, but most of them become shorter branchlets with definite growth; these branchlets are repeatedly pseudodichotomously ramified, having very long cylindrical cells often reaching a length of 3 mm. or even more, while their breadth is only about 100 μ.

Fig. 208. *Callithamnion* spec. *a*, upper end of a plant. *b*, part of a filament with rhizoids. (About 40 : 1).

The few tetrasporangia found were tetrahedrally divided.

Found in a depth of about 10—12 meters.

St. Thomas: In the sea to the west of Water Island where in many places it occurred in large quantities.

Seirospora Harvey.

Seirospora occidentalis Børgs.

Børgesen, F., Some new or little known West Indian Florideæ (Bot. Tidsskr. vol. 30, 1909, p. 14).

This interesting plant (Fig. 209) was found among the abovementioned *Callithamnion cordatum* as an epiphyte upon *Gracilaria Blodgettii.*

Fig. 209. *Seirospora occidentalis* Børgs. Part of a female plant. (About 70 : 1).

The plant is much ramified and forms small, dense bushes about 1—2 cm. high.

The main stem is fastened to the host plant by means of short, thick-walled rhizoids emerging from the lowermost cells (Fig. 210 *A*). The cells found here are short, nearly as long as broad, about 200 μ thick having very thick walls (the wall ca. 40 μ thick).

Higher up in the stem the cells grow evenly, thinner in the middle of the plant about 85 μ thick, becoming at the same time more thin-walled and longer (4—5 times as long as broad), decreasing in thickness evenly towards the apex, the ultimate cells being only 8—11 μ thick. These often, but not always, end in a thin hair (Figs. 210 *D*, 211 *A*). Breadth of the hair about 3 μ.

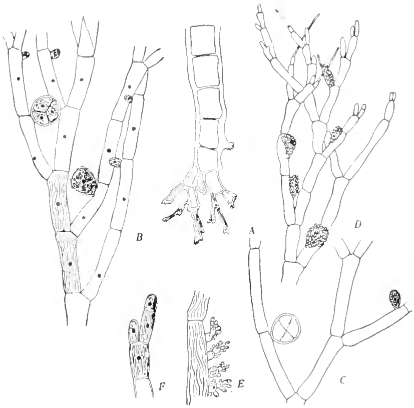

Fig. 210. *Seirospora occidentalis* Borgs. *A*, base of a plant (25 : 1). *B* and *C*, branches with tetraspores (60 : 1). *D*, branch with antheridia (60 : 1). *E*, antheridia (150 : 1). *F*, cells with chromatophores and nucleus (150 : 1).

The plant is not corticated. It is richly ramified on all sides, in the uppermost part subdichotomously.

Both the younger and older cells have only a single nucleus (Fig. 210 *B*, *F*), in accordance with the description of SCHMITZ[1]). The parietal chromato-

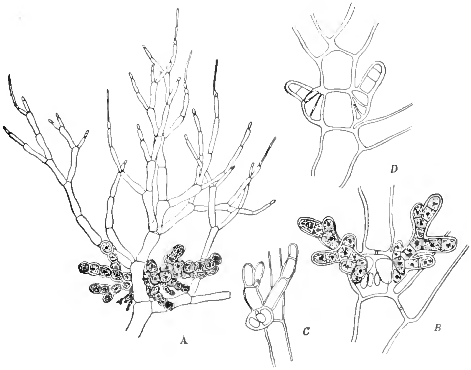

Fig. 211. *Seirospora occidentalis* Borgs. *A*, branch with nearly ripe cystocarp. *B*, *D*, young cystocarps (150 : 1). *C*, procarp (150 : 1).

[1]) SCHMITZ, FR., Die Gattung *Microthamnion* J. Ag. (= *Seirospora* Harv.) Ber. d. deutschen bot. Gesellsch., Bd. XI, 1893, p. 273.

phores are thread-like, shorter or longer, and irregularly sinuated (Fig. 210 *B*, *E*, *F*).

I have found plants with tetraspores, antheridia and cystocarps, which all occur on separate individuals.

The tetraspores are sessile on the uppermost and inner side of the mother-cells (Fig. 210 *B*, *C*), when young they are oval or obovate, when quite developed nearly spherical; they are commonly tetrahedrally divided more seldom cruciately (Fig. 210 *C*).

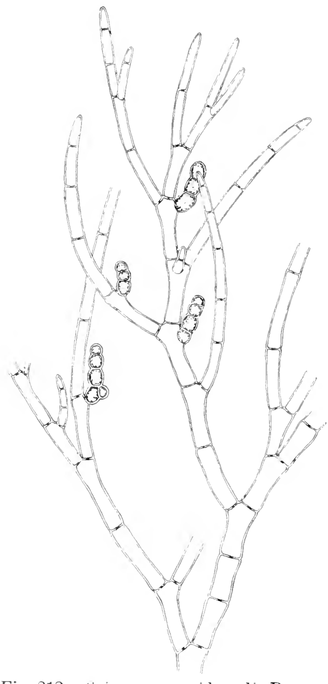

Fig. 212. *Seirospora occidentalis* Børgs. Part of a plant with paraspores. (About 125 : 1).

The cystocarps are composed of two oppositely-placed gonimoblasts, which, when ripe, consist of the ramified moniliform threads of the uniseriated, nearly spherical carpospores (Figs. 209, 211 *A*); the latter are about 40—42 μ broad. These peculiar seirosporic cystocarps agree very well, apart from the form and size, with those found in *Seirospora Griffithsiana* Harv. and which Bornet was the first (Notes algologiques, I (1876) p. XIV) to explain as cystocarps in contradistinction to the paraspores (seirospores) also occurring in this plant.

Fig. 211 *C* shows a procarp. I have only succeeded in finding remains of the trichogyne, it seems to be very short-lived as Schmitz (l. c., p. 280) also mentions being the case in *Seirospora interrupta* (Engl. Bot.). Most probably this is the reason why Buffham[1]) has not detected the trichogynes in plants examined by him.

[1]) Buffham, T. H., On the reproductive organs, especially the Antheridia, of some of the Florideæ. (Journal of the Queckett Microscopical Club, Vol. IV, Ser. II (1891) p. 252).

I have not been able to see with certainty, in the rather scanty material, whether the carpogonial branch consists of 3 or 4 cells. Schmitz (l. c.) in his diagnosis of the genus *Seirospora* describes the carpogonial branch as most often 4-celled, but in *Seirospora interrupta* he found (l. c. p. 280, note 3) the carpogonial branch consisting of 3 cells only.

After fertilization both the auxiliary cells begin to divide and produce the ramified, sporogenous filaments of which the cystocarps consist.

The antheridial stands are distributed in the same way as the tetraspores, placed on the uppermost and inward side of the mother-cell (Fig. 210 *D*). They consist of quite short branchlets which bear the spermatangia. Most often they grow quite closely together in dense tufts, sometimes too, as Fig. 210 *E* shows, more scattered.

When I described this plant I had not come across the paraspores. Having now examined some more collections of algæ I have twice found plants with paraspores which I refer, without hesitation, to this species. In one of the collections (from St. Thomas, Fig. 212) the specimen with paraspores was found together with other fructiferous parts of this plant; in the other (from St. Croix) the paraspore-bearing specimen was not found in company with any other specimen of this species.

The branchlets forming the paraspores occur in the same places as the tetrasporangia, viz. at the upper and inner side of the cells in the filaments. They consist of short cells filled with reserve nutriments. The cells have thick walls, and become, when ripe, nearly spherical. The diameter of the paraspores is about 18—20 μ.

This species has been found epiphytic upon *Gracilaria Blodgettii* in a depth of about 15 fathoms and besides I have found a few specimens intermingled among *Cladophora* and *Callithamnion* in about the same depth. Once it was found washed ashore growing upon an old piece of *Sargassum vulgare.*

It has been found in several places in the sound between St. Thomas and St. Jan: e. g. off Christiansfort. St. Thomas in the sea to the west of Water Island. St. Croix: near the estate Lt. Princess (washed ashore).

Geogr. Distrib.: Hitherto not found in other regions.

Subfam. 5. Crouanieæ.

Antithamnion Nägl.

1. **Antithamnion antillanum** nov. spec.

Fronde cæspitosa, filis repentibus decumbentibusque, substrato adfixis, filis erectiusculis ramulis oppositis instructis.

Ramuli alterne pinnati, pinnis pinnulas singulas (raro plures) in exteriori latere gerentibus; pinnulis plerumque ex binis-quaternis (raro pluribus) cellulis compositis, in superiori (interiori) latere glandula ovata instructis.

Tetrasporangia cruciatim divisa, e cellula basali pinnularum orta.

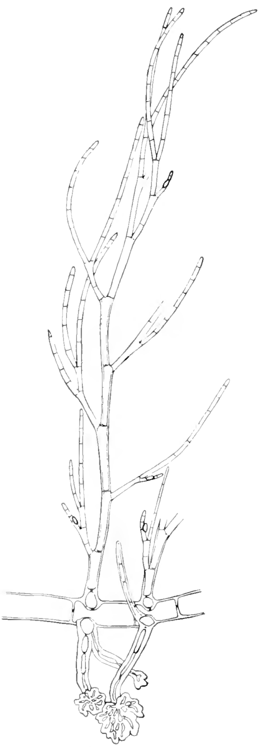

Fig. 213. *Antithamnion antillanum* nov. spec. Part of a decumbent filament from which downwards rhizoids, upwards branchlets are issued. (About 85 : 1).

The base of the plant consists of decumbent, creeping filaments, from which the erect filaments arise; often, too, the ends of these filaments grow upwards. The creeping filaments are fastened to the host plant by means of vigorous haptera (Fig. 213). The stalk of the hapteron is of variable length, often moniliform, the cells being oval of shape. They have thick walls; their length varies between 35—65 μ or more, their breadth is about 20—25 μ. The stalk ends in a flat, disk, consisting of coherent rhizoids.

The erect filaments Fig. 214 are oppositely and distichously ramified and bear two kind of branches: some of them growing out as main stems like themselves, the others as short branchlets with limited growth.

The cells in the main stem are nearly cylindrical, of variable size from 70—200 μ long and about 40—50 μ broad.

The branchlets (Fig. 215) are alternatingly ramified, the pinnæ being placed distichously along both sides of the rachis.

The basal cells in the branchlets are small, nearly quadratic (comp. Figs. 213 and 214), while the other cells in the rachis are nearly cylindrical, a little thicker upwards where the pinnæ issue. The basal cell is very persistent, more or less immersed in the mother cell and remains after the branchlets have died; as pointed out by Howe[1]) for *A. densum* so in the present species also, rhizoids grow out from this cell; adventitious, erect filaments too arise from it.

The cells in the rachis of the branchlets are from 20—24 μ broad and 50—150 μ long or more. The pinnæ are simple or ramified and generally provided with a single pinnule growing out mostly from the secund cell from the base on the distal side of the pinnæ (Fig. 215). These pinnules (Fig. 216 *b*, *c*, *d*) consist generally of two to four, seldom more, cells about $1^1/_2$ times as long as broad (long. cell. = 10 μ, lat. 13 μ). Nearly everyone of these small pinnules carry a large, oval, clear gland-cell on their upper (inner) side. This is 20 μ long and 13 μ broad.

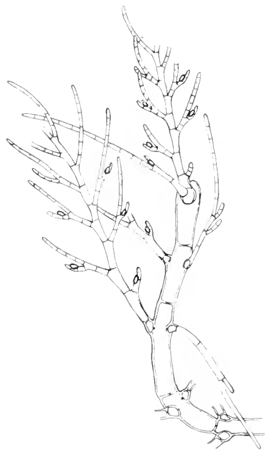

Fig. 214. *Antithamnion antillanum* nov. spec. Part of a plant. (About 85 : 1).

As to the development and position of the glands the present plant seems to come near to *A. cruciatum* according to the description by Nestler[2]), still a few small differences occur. While in the latter plant the gland-cell is in contact with 3—4 cells, in my plant, as a rule, it abuts on to two cells, or more seldom three cells (Fig. 216 *b*, *c*, *d*). Nor have I ever in my plant seen the "stab-oder leistenförmigen Bildungen" which Nestler found in *A. cruciatum*; but, of course, it must be remembered that I have not been able to examine living material. As to the development of the gland-cells I have once come across (in the very scarce material at hand)

[1]) Howe, M. A., The marine Algæ of Peru. (Memoirs of the Torrey Bot. Club, vol. XV, 1914, p. 151).

[2]) Nestler, A., Die Blasenzellen von Antithamnion Plumula (Ellis) Thur. und Antithamnion cruciatum (Ag.) Näg. (Wissensch. Meeresuntersuchungen, III. Bd., 1, 1899).

Fig. 215. *Antithamnion antillanum* nov. spec. Branchlet with gland-cells. (About 180 : 1).

a young state (Fig. 216 *e*); this seems exactly to correspond to the description and figures of NESTLER. A young cell, the first beginning to the pinnule carrying the gland-cell, we find divided, by a longitudinal, somewhat curved wall, into two cells; of these the smaller one is the young gland-cell, while the larger cell afterwards by transverse walls is divided in two to four, seldom more cells.

In the dried material a few tetrasporangia occurred (Fig. 216 *a*). These were of an oblong-cylindrical shape, about 90 μ long, and 40 μ broad, with broadly rounded apex and base; they were cruciately divided. The few tetrasporangia "in situ" I have come across were placed upon the basal cells of the pinnæ in the corner between this and the rachis of the branch.

As to the gland-cells the present *Antithamnion*, as mentioned above, is closely related to *A. cruciatum*, but on the other hand it differs essentially from this species. As to these organs my plant seems to come near, also, to GRUNOW's *Sporacanthus compactus*[1]), but otherwise it has no likeness to this plant.

We may point out as the most characteristic features of our plant: the alternate branching of the branchlets throughout, the mostly single pinnule on the under (outer) side of the branchlets provided on its upper side with the gland-cell, and

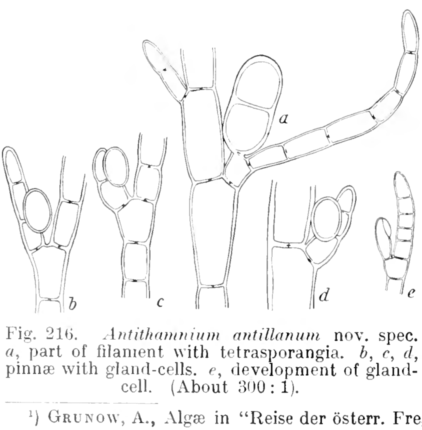

Fig. 216. *Antithamnium antillanum* nov. spec. *a*, part of filament with tetrasporangia. *b*, *c*, *d*, pinnæ with gland-cells. *e*, development of gland-cell. (About 300 : 1).

[1]) GRUNOW, A., Algæ in "Reise der österr. Fregatte Novara", 1870, p. 60, tab. 6, fig. 3.

the large, subcylindrical tetrasporangia placed, as far as I have seen, at the base of the filament.

The plant has been found as an epiphyte upon old remains of larger algæ in shallow water and in a rather sheltered place.

St. Thomas: In the harbour of this island near the town Charlotte Amalie.

2. **Antithamnion** spec.

Having had only a few sterile, small specimens of this plant at my disposal I prefer to let it remain without a specific name.

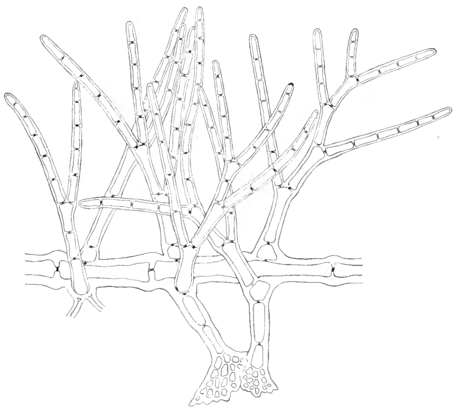

Fig. 217. *Antithamnion* spec. Part of a decumbent filament with rhizoids and erect filaments (About 175:1).

The plant has decumbent, creeping filaments (Fig. 217), fastened to the substratum (*Sargassum vulgare*) by means of haptera; these have a short stalk consisting of more or less moniliform cells, ending in a small irregularly lobed disk. The cells in the stalk are about 50 μ long and 27 μ broad.

The cells in the creeping filaments are nearly cylindrical with thick walls; they are about 40 μ broad and 115 μ long. From these basal filaments the erect ones arise; the ends of these creeping filaments often being assurgent too.

The erect filaments are oppositely ramified, each joint bearing two branchlets cruciately alternating with the pair below (Fig. 218). A few of these branchlets grow out as filaments like the main stem; by far the greater part remain short with definite growth. The cells in the main stem are of variable size in the different filaments; they are nearly cylindrical, a little thicker above the place where the branchlets issue; their length varying about 100 μ, their breadth about 30 μ.

The branchlets are alternatingly ramified. The lowest cells in the branchlets are short often nearly spherical; the other cells

are cylindrical 2—3 times as long as broad. In the basal part of the branchlets the cells are about 16 μ broad, tapering gradually upwards; the uppermost ones in the end of the filaments are often short, conical. The chromatophores consist of irregularly shaped discs or short plates.

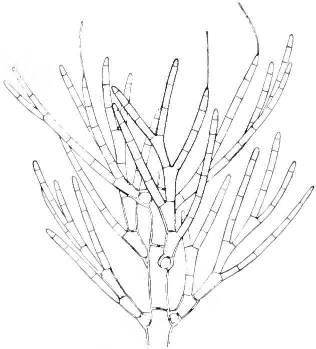

Fig. 218. *Antithamnion* spec. Part of an erect filament. (About 140 : 1).

At the summit of the young branchlets long, thin hairs are generally present (Fig. 218); these hairs are about 3 μ thick and about 80 μ long. Gland-cells did not occur in this plant.

As mentioned above the plant was quite sterile, neither tetrasporangia, nor other reproductive organs were found.

This plant seems to come near to *A. cruciatum*, but the few specimens I have seen were destitute of gland-cells, had always opposite, not verticillate branchlets, these being alternately, not oppositely branched.

The plant was found epiphytic upon an old specimen of *Sargassum vulgare* washed ashore.

St. Croix: Near the estate Lt. Princess in the neighbourhood of Christiansted.

Crouania J. Ag.

1. Crouania attenuata (Bonnem.) J. Ag.

Agardh, J., Algæ mediter., 1842, p. 83; Spec. Alg. vol. II, p. 105; Epicrisis, p. 84. Harvey, W. H., Nereis Bor.-Am., p. 226, pl. 31 D; Phycol. Brit., pl. 106. Crouan in Ann. Sc. Nat., Bot., Sér. III, 1848, p. 375, tab. 12, figs. 24—25.

Crouania bispora Crouan in Ann. Sc. Nat., Bot., Sér. III. p. 374, tab. 12, figs. 21—23.

Mesogloia attenuata Ag., Systema, p. 51.

(For more synonyms comp. also De Toni, Sylloge Alg., vol. IV, Florideæ, p. 1417).

This species occurs in shallow water both in exposed and sheltered places, and in deep water; as the specimens vary rather much according to the different growing places I shall first give a short description of a plant from an exposed locality and afterwards compare it with a specimen from deep water.

The specimen from an exposed place which I am going to describe was growing upon *Amphiroa fragilissima* originating from a coral reef at the south coast of St. Croix.

The specimens found here are scarcely 1 cm. high. Their colour is more or less bluish green, while specimens from more protected places and from deep water have a red brown colour.

The thallus consists of a central ramified filament composed of large cylindrical cells near the upper end of which a whirl of 4 di- or trichotomously ramified branchlets are issued (Fig. 219).

The basal part of the filaments is decumbent and fastened to the host plant by means of rhizoids. In the most vigorously developed rhizoids the stalk is moniliform owing to the oval shape of the thickwalled cells, in the less vigorous cylindrical; the stalk ends in short, irregularly ramified filaments often forming a small disc. These rhizoids grow out from the basal cell of the branchlets (Fig. 220).

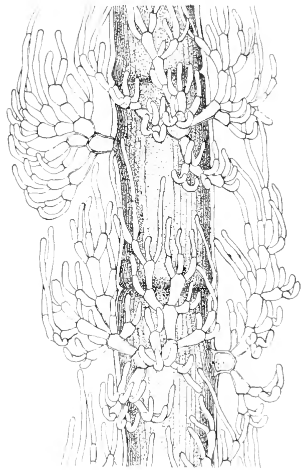

Fig. 219. *Crouania attenuata* (Bonnem.) J. Ag. Part of a main filament with branchlets. (About 240 : 1).

The cells in the central filaments are cylindrical with thick walls; in vigorous filaments they reach a length of about 180 μ and a breadth of 120 μ. They are not corticated. The branchlets are repeatedly di- or trichotomously ramified; the cells in the branchlets are broadest and shortest near the base, tapering gradually upwards growing at the same time longer. The uppermost ones, in any case in the lower part of the thallus, are often long cylindrical growing up between the filaments of the branchlets above, and because of this, covering in most cases the main stem quite densely (Fig. 219).

In the cells of the branchlets we find well developed chromatophores. These consist of a parietal campanulate plate, downwards with large openings or with irregularly shaped prolongations. In the cells of the central filaments the chromatophores, on the

other hand, are much less developed; they are here present as quite thin ribbons with a great distance between them.

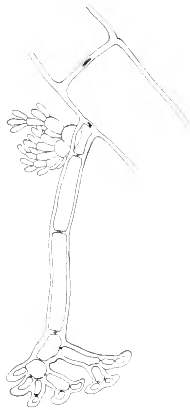

Fig. 220. *Crouania attenuata* (Bonnem.) J. Ag. Rhizoid growing out from the basal cell of a branchlet. (About 120 : 1).

If we now compare these small, but robust specimens with the ones occurring in deep water, we shall find the habit of the plant much altered. The plant is much larger often 2—3 cm. high, but, on the other hand, much more slender and weakly developed. All parts of the plants are more or less elongated, the cells of the central filaments being longer, but less broad and having thinner walls. The same holds good with regard to the branchlets, these being, on the whole, less developed, shorter, and not forming such a dense cover round the axis as they did in most cases in the plants from exposed places.

As to the reproductory organs I have only found tetraspores and antheridia.

The tetrasporangia issue from the basal cell in the branchlets (Fig. 221): they are cruciately divided.

The antheridia are developed quite in the same way as described for *Crouania Schousboei* Thur. by BORNET and THURET in Notes algologiques (p. 185, pl. 49, fig. 5). The peripheric cells of the branchlets are repeatedly dichotomously ramified, and the uppermost ones of the small cells, resulting from these divisions, are the antheridia.

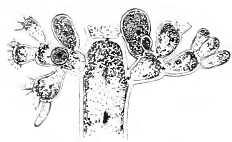

Fig. 221. *Crouania attenuata* (Bonnem.) J. Ag. Bases of branchlets with young tetrasporangia. (About 400 : 1).

The plant has been found with tetraspores and antheridia in the months of Jan.—March.

As mentioned above it occurs as well in shallow water as in deeper; when growing in shallow water it is often found in rather exposed places where it is dashed constantly by the waves: in such places it often occurs as an epiphyte upon *Amphiroa fragilissima*. In deep water I have only collected it once at a depth of about 20 meters; it was here fastened to *Caulerpa crassifolia*.

Crouania attenuata seems to be a common species along the shores of the Islands.

Geogr. Distrib.: Mediterranean Sea, warmer shores of the Atlantic Ocean.

Subfam. 6. Spyridieæ.

1. **Spyridia filamentosa** (Wulf.) Harv.

Harvey, W. H., in Hooker, Brit. Flora, vol. II, 1833, p. 336; Manual Brit. Alg., 1841, p. 101; Phycologia Britannica, pl. 46; Nereïs Bor.-Am., 1853, part II, p. 204. Agardh, J., Spec. Alg., vol. II, p. 340; Epicrisis, p. 268. Farlow, W. G., Mar. Alg. of New England, 1881, p. 140, pl. X, fig. 1 and pl. XII, fig. 2. Hauck, F., Meeresalgen, p. 115. De Toni, Sylloge Alg., vol. IV, sect. III, p. 1427 (ubi synomyna pluria).

Fucus filamentosus Wulfen, Cryptogama aquatica in Roemer's Archiv für die Botanik, III, 1803, p. 64.

Spyridia filamentosa is a very variable plant as is sufficiently clear from the many names the different forms have received in the course of time. To understand this we need only to consider the many different forms Kützing has figured in "Tabulæ phycologicæ", having put them down as separate forms (comp. De Toni, l. c.). It is, of course, always a difficult thing to decide, whether any of these forms really ought to be considered as a proper species or not. But to judge from the West Indian material the species seems to be a very plastic plant, highly influenced by the external conditions. In the West Indies I have found it in more sheltered places and in shallow water. It is common in lagoons and bays, but the mechanical influence of the waves may often be strong even in such places e. g. in certain places in the harbour of Charlotte Amalia. Light is another factor having much influence upon the shape of the plant. Of course this varies a good deal according to whether the plant is growing upon coral reef or attached to the roots of mangroves, thus growing in the shade of these trees. And again whether it grows in clear

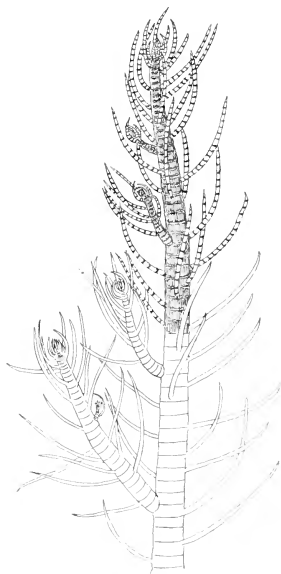

Fig. 222. *Spyridia filamentosa* (Wulf.) Harv. Part of a specimen from the coast of St. Croix near Christiansted. (About 16:1).

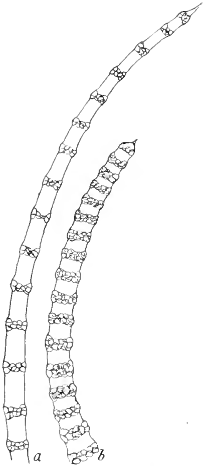

Fig. 223. *Spyridia filamentosa* (Wulf.) Harv. *a*, a ramulus with long cells from the specimen figured in Fig. 222. *b*, a ramulus with short cells from the specimen figured in Fig. 224. (About 100 : 1).

water upon stones lying upon the dazzling white sand bottom or in lagoons in muddy water. Often, too, it is found together with other algæ as entangled masses lying loose upon the bottom. From this it is clear that the external conditions under which this plant grows in the West Indies are very variable.

The specimens found are ramified on all sides (Fig. 222). They have corticated branches and branchlets. Some differences, as to the more or less rich ramification or to the shape and size of the bark-cells, may occur, but it is not here that the essential differences are to be found. It is in the case of the size and shape of the ramuli that we find the chief differences (comp. fig. 223). These may be thick, or thin, in some specimens they have a broad base and taper evenly upwards, in others they have nearly the same breadth along their whole length. The first mentioned end in a long attenuate spine, the last mentioned in a short spine. The cells in the ramuli are either cylindrical. or barrel-shaped, in some specimens nearly as long as broad, in others often more than three times as long as broad. No doubt these variations are due to the influence of different external conditions. For instance specimens growing in more open places, upon coral reefs etc. in strong light have vigorous, but mostly short ramuli with short cells, while specimens from lagoons growing in the shade of the mangroves have long, thin ramuli with long cells. In some specimens I have found numerous long, thin hairs issuing from the cortical cells; these were growing in an open place with much light.

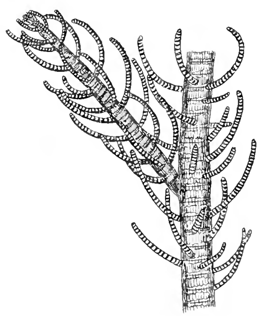

Fig. 224. *Spyridia filamentosa* (Wulf.) Harv. Part of specimen with short robust ramuli from Cruz Bay, St. Jan. (About 16 : 1).

The figure (Fig. 222) shows a part of a specimen from a more protected

place with rather long ramuli, and Fig. 224 another specimen from an open place with short, robust ramuli.

Farlow points out (in "The Marine Algæ of New England", p. 140) that: "The individuals which bear the cystocarps are distinct from those which bear the antheridia. and may be recognized by their more dense habit". The single cystocarpic specimen I have come across was very like the one figured in (Fig. 222). Fig. 225 shows a bilobed cystocarp; in the halfpart to the left the arrangement of the carpospores is seen. Fig. 226 is the reproduction of a transverse section of a young cystocarp. Antheridial plants were not found.

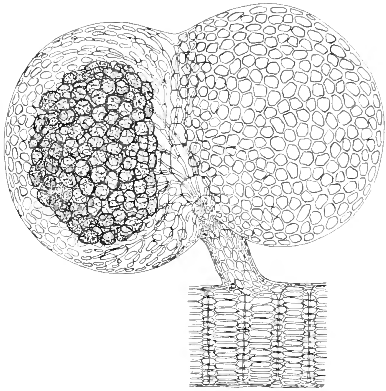

Fig. 225. *Spyridia filamentosa* (Wulf.) Harv. A cystocarp. (About 100 : 1).

Some of the specimens had tetrasporangia. These occured at the base of the ramuli, one to three growing out from each bark-ring.

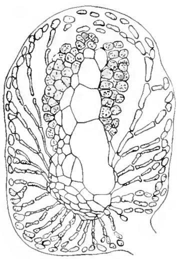

Fig. 226. *Spyridia filamentosa* (Wulf.) Harv. Transverse section of a young cystocarp. (About 100 : 1).

This species is very common along the shores of the islands.

Geogr. Distrib.: West Indies, warmer parts of the Atlantic Ocean, Mediterranean Sea, Red Sea, Indian Ocean.

2. Spyridia clavata Kütz.

Kützing, F., in Linnæa, vol. XV, 1841, p. 744; Spec. Alg. p 667; Tabulæ phycologicæ, vol. XII. tab. 45, figs. *c*, *d*. J. Agardh, Species Algarum vol. II, p. 344; Epicrisis, p. 271.

This plant (Fig. 227) is originally described from a specimen from St. Thomas which Kützing received from Senator Binder. The description below is based upon specimens collected by me, not only at St. Thomas, but also at St. Croix.

The thallus is terete. The ramification is distichous, both the branchlets and the ramuli issuing seriate from both sides of the frond.

The most characteristic feature of this species is the clavate shape of the branchlets. The upper part of the branchlets is thickened, having for the most part no ramuli, but sometimes a few and scattered ones may be found. Even the main filaments are sometimes more or less clavate in their upper end, most probably in such plants in which the growth begins to be slow, else the main filaments taper evenly towards their summit.

The ramuli are short and robust, about 600 μ long. They are upwards curved and keep nearly the same breadth from their base to a little above their middle, tapering then rather quickly and ending in an acute spine composed of 3—4 superposed, small cells. Sometimes the ramuli, too, taper towards their base, these being thickest in the middle. The cells in the ramuli are mostly as long as broad; in the middle of the ramuli about 60 μ long and 55 μ broad. At the transverse walls a whorl of small cortical cells are present.

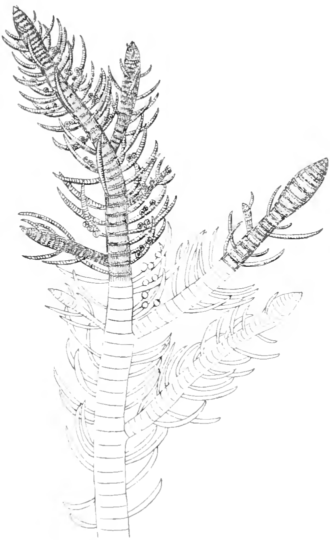

Fig. 227. *Spyridia clavata* Kütz. Part of a plant. (About 18 : 1).

The main filaments as well as the branchlets are corticated. The cortex consists of alternating series of cells: shorter, oval ones above the transverse walls of the large central cell and longer, cylindrical ones between them. The first mentioned are about 25—40 μ broad and 45—70 μ long, the cylindrical are about 60—70 μ long and often not more than 8 μ broad.

Upon specimens preserved in spirit the large central cells are very easily seen; in the main filaments the joints are about $2^1/_2$ times as broad as long.

The nearly spherical tetrasporangia are seriately placed upon the upper side of the ramuli near their base: sometimes the tetrasporangia occur also on the lower sides of the ramuli. They are tetrahedrally divided, having thick walls, their diameter reaching about 50 μ.

This plant has been collected partly in a more sheltered locality in shallow water, and partly in the open sea in a depth of about 12 meters.

St. Thomas: In the Harbour at Charlotte Amalia. St. Croix: Off Frederikssted.

Geogr. Distrib.: West Indies, Senegambia.

3. **Spyridia aculeata** (Schimp.) Kütz.

Kützing, F., Phycologia generalis, 1843, p. 377; Spec. Alg., 1849, p. 668; Tabulæ phycologicæ, vol. XII, pl. 51, figs. *a*, *b*. Agardh, J., Spec. Alg.,

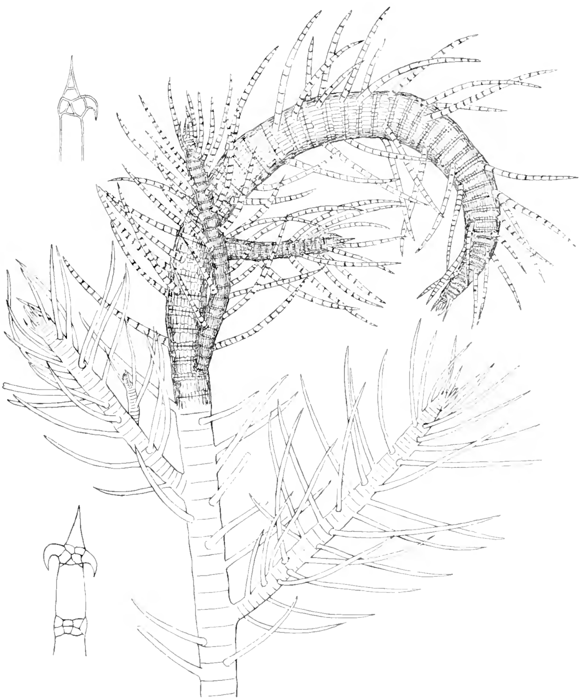

Fig. 228. *Spyridia aculeata* var. *typica*. Upper end of a branch with tendril, and two summits of ramuli. (About 18 : 1 and 200 : 1).

vol. II, pars II, p. 342; Epicrisis, p. 271. HARVEY, W. H., Nereis Bor.-Am., 1853, part II, p. 205.

Spyridia armata Kütz., Tabulæ phycologicæ, vol. XII, pl. 50, figs. *c*, *d*.

Spyridia Berkeleyana Mont. in Exploration scientifique de l'Algérie, p. 141, pl. 15, fig. 6.

Ceramium aculeatum Schimper in Unio itin., n. 966 (non vidi).

var. *typica* (Fig. 228).

The thallus is terete. The main filaments and branchlets are corticated; the cortex consists of alternating rows of slender, cylindrical cells and shorter, oblong ones; the cylindrical cells are about 55 μ long and 13 μ broad, the oblong cells about 40 μ long and 24 μ broad.

The branchlets and ramuli issue from all sides of the branches, but a more or less marked tendency to distichous ramification is often present in the specimens examined. At their base the branches are often somewhat slender than higher up in the branch; e. g. the base of a branch was 160 μ broad, while higher up the same branch had a breadth of 210 μ. Towards their summits the branches and branchlets taper evenly.

The ramuli are broadest at their base and taper evenly upwards. They are about 1 mm. long. The basal cells in the ramuli are about 100 μ long and 60 μ broad, in the middle of the filaments only 37 μ broad while their length is nearly the same. At the transverse walls a whorl of small cortical cells are present. The ramuli end in a mucronate tip composed of 2 cells, and besides a few (one to three) uncinate spines are very often developed from the cortical cells below.

HARVEY l. c. gives a good description of this species. As pointed out by this author, which my specimens confirm, the upper end of the filaments is often incrassated and revolute, forming in this way a hook-shaped tendril by means of which the plant is able to fasten itself to other algæ. The upper parts of these tendrils are often more or less destitute of ramuli.

var. *disticha* n. v.

A forma typica præcipue differt fronde plus minus regulariter plumosa, ramis alternis distichis ramulisque a margine egredientibus constructa.

The specimens I refer to this form are especially distinguished from the typical one by the distichous arrangement of the

branchlets and ramuli. By this and also by the very regular alternating of the branchlets the plant has often a fine, feathery appearance. To judge from J. AGARDH's description of *Spyridia complanata* this plant seems to be very like the present form, but, while my plant has a terete thallus, AGARDH's plant is said to be compressed. On account of this I prefer to consider my plant as a form of *Sp. aculeata.*

Of this form I have had specimens from both shallow and deep water (about 30 meters). The specimens from shallow water are very robust and densely ramified; the ramuli are short and thick, composed of nearly quadratic cells which, in the lower part, are about 70 μ long and broad. Uncinate spines are developed, not only from the uppermost cortical ring in the ramuli, but sometimes, too, from the next one.

Compared with these specimens the ones from deep water are much more slender in all respects. The ramuli are of more than double the length, their cells slender and much longer, about 50—60 μ broad, 130 μ long. The specimens have a beautiful, feathery appearance.

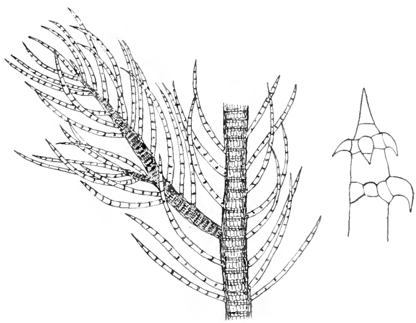

Fig. 229. *Spyridia aculeata* (Schimp.) Kütz. var. *disticha* n. v. Part of a plant and the upper end of a ramulus. (About 18 : 1 and 200 : 1).

f. *inermis* n. f.

A var. disticha præcipue differt aculeis uncinatis rarissimis aut nullis.

This form is characterized by the absence of the uncinate spines upon the ramuli. On account of this fact I was at first inclined to consider it as a new species, but after a more thorough investigation, having examined several parts of different specimens, I have twice come across a ramulus bearing a single uncinate spine, and I therefore prefer to consider it as a non-aculeate form of the present species to which it otherwise shows very great likeness.

The specimens found reach a height of more than 20 cm.

The plant is densely ramified, and the branchlets, as well as the ramuli, issue distichously from both sides of the branches, these by this getting a beautifully feather-like appearance. The thallus is terete and, with the exception of the ramuli, densely corticated. In the younger parts of the branches the cortical layer consists of alternating rows of cells as described above for the typical form, and like this one the ends of the branches and branchlets often end in tendrils.

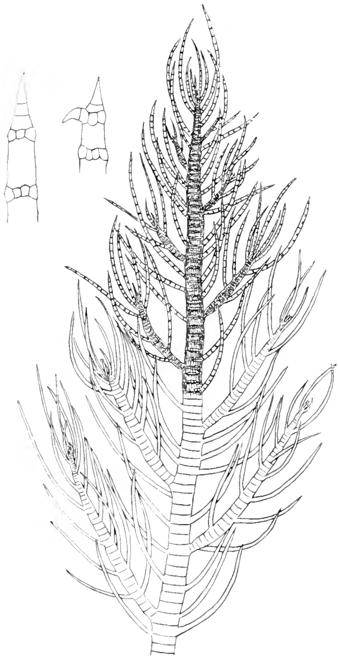

Fig. 230. *Spyridia aculeata* (Schimp.) Kütz. f. *inermis* n. f. Part of the thallus and summits of two ramuli, the one with a hook. (About 18 : 1 and 200 : 1).

The ramuli, too, except for the absence, of the uncinate spines, seem quite to agree with those of the typical form. They are bent upwards, having a rather broad base, about 60 μ, and tapering gradually towards their summit which consists of a rather long, mucronate tip. At the base the cells are about as long as broad, higher up about $1^1/_2$ as long as broad.

This species has been found in shallow water in more or less sheltered localities and in deep water down to a depth of about 30 meters. It is mostly an epiphyte fastened to other algæ.

F. *typica* has been found in the following localities: St. Croix: Near Long Point and at Buck Island in a depth of about 5 fathoms.

Var. *disticha*. St. Croix: At the shore near the estate Cassava Garden. St. Jan: Off America Hill in a depth of about 16 fathoms.

F. *inermis*. St. Croix: Near the shore at Green Cay Estate.

Geogr. Distrib.: West Indies, Southern Atlantic shores of Europe, Maroc, Mediterranean Sea, Red Sea.

Subfam. 7. Ceramieæ.[1]

Centroceras Kützing.

1. Centroceras clavulatum (Ag.) Mont.

MONTAGNE, C., Exploration scientifique de l'Algérie, Algues, Tome I, 1846, p. 140. J. AGARDH, Spec. Alg., p. 148; Epicrisis, p. 108. HARVEY, Nereis, Bor.-Am., Part II, p. 211, tab. 33 C.

Centroceras clavulatum Ag. in KUNTH, Synopsis Plantarum, vol. II, 1822, p. 2.

Of this species, which is very common in the West-Indian seas, a series of specimens has been examined, frequently differing from each other, but, so far as we can judge, the variations in question are only modifications due to different localities. Most of the specimens are sterile; tetrasporangia have been found now and then, but no cystocarps.

Centroceras clavulatum is fixed to the substratum by means of rhizoids. These have a shorter or longer pluricellular stalk, ending in an irregularly lobed disc.

This species is found in very varying localities, from the most exposed to quite sheltered. Thus it is common in the calm water of the lagoons, fixed to the roots of the mangroves. And on the other hand it is found upon the rocky shore of the north west end of St. Croix, where it is constantly washed by the waves.

It seems to occur in shallow water only. In deep water it has never been met with.

It is very common along the shores of the islands.

Geogr. Distrib.: Seems to occur in all warmer seas.

Ceramium Lyngbye.

1. Ceramium fastigiatum (Roth) Harv.

HARVEY, W. H., Remarks on some British Algæ in HOOKER, Journal of Botany, vol. V, 1834, p. 303. J. AGARDH, Spec. Alg., vol. II, p. 119.

Conferva fastigiata Roth, Catalecta botanica, II, 1800, p. 175.

f. *flaccida* H. E. P. n. f.

Ceramium fastigiatum was originally described by ROTH, later on adopted by HARVEY, supported by Mrs. GRIFFITHS, but with

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[1]) Dr. HENNING E. PETERSEN has most kindly determined my material of the *Ceramieæ* and the systematic notes are due to his thorough knowledge of this group.

no indications as to the position of the tetrasporangia; J. AGARDH gives a very good and detailed description of it. Judging from that this species appears to be like a *Ceramium diaphanum*, regularly dichotomous and with isolated projecting tetrasporangia. However, when these organs are not present, this species is not easily recognizable.

In referring the present specimens to *Ceramium fastigiatum* we have in view the shape and size of the tetrasporangia. As these, however, do not seem to agree entirely with the typical form described by HARVEY (Phycologia Britannica, pl. 255) it seems preferable to consider them as representing a special form: f. *flaccida*, so called because their filaments are extremely thin and flabby.

Fig. 231. *Ceramium fastigiatum* (Roth) Harv. f. *flaccida* H. E. P. *a*, part of a young filament; *b*, part of an older one; *c*, zone with tetrasporangia. (About 250:1). H. E. P. del.

The tufts are 4—5 cm high, built up by dichotomous threads. The axial cells are about 400 μ long, 50 μ broad, with zones 30—40 μ high and 50 μ broad, often only 20 μ high. The zones do not increase in the margins; the upper marginal cells are often smaller than the other cortical cells. No glandular cells are present. The summits of the filaments are not very curved and the zones are here quite close together. The tetrasporangia are isolated and prominent. Sexual organs are not present.

Of the specimens of *C. fastigiatum* distributed in Phycotheca Bor.-Am., No. 446 the uppermost one of those belonging to the Botanical Museum, Copenhagen, agrees in some respects with the present form, especially as to the shape and size of the zones. The other specimen is a typical *Ceramium strictum*.

Ceramium fastigiatum f. *flaccida* is found in sheltered localities and in shallow water and grows upon the roots of the mangroves, to which it is fastened by means of mostly short, uni-

cellular rhizoids ending with a small, lobed disc; but longer and pluricellular rhizoids, too, are present.

St. Croix: Christiansted's Lagoon. St. Thomas: Bovoni Lagoon. St. Jan: Coral Bay.

Geogr. Distrib.: Warmer parts of the Atlantic Ocean.

2. **Ceramium strictum** Grev. et Harv.

in Harvey, Phycologia Brit., pl. 334. J. Agardh, Spec. Alg. vol. II, p. 123.

Specimens belonging to this species were found in some few collections together with other algæ.

The axial cells reach a length of up to 400 μ, the breadth being up to 100 μ. The zones are 50—60 μ high and 70—110 μ broad, thus a little smaller than is usually the case. Plants with tetraspores and cystocarps were found. The tetraspores are arranged verticillately and often developed in the nearly straight summits of the filaments.

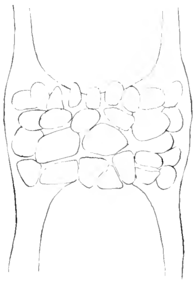


Fig. 232. *Ceramium strictum* Grev. et Harv. Zone of a filament. (About 225:1). H. E. P. del.

This species has been found occasionally in shallow water in both sheltered and exposed localities.

St. Croix: In the harbour of Christiansted, Coakley Bay. St. Thomas: Store Nordside Bugt.

Geogr. Distrib. Warmer shores of the Atlantic Ocean; Mediterranean Sea.

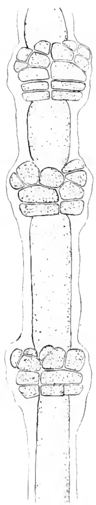


Fig. 233. *Ceramium transversale* Collins et Hervey. Part of a filament. (About 370:1.)

3. **Ceramium transversale** Collins et Hervey.

Collins, F. S. and A. B. Hervey, The Algae of Bermuda in Proc. of the American Acad. of Arts and Sciences, vol. 53, No. 1, p. 145, pl. V, figs. 29—31.

This well defined *Ceramium*-species has been described in the above mentioned paper, recently published. It is especially characterized by the transversely elongated lower cells of the zones. Specimens with tetraspores were found.

On the shores of the islands this plant was found as an epiphyte upon *Laurencia obtusa* upon the fronds of which it creeps.

It was found in very exposed places in the littoral region.

St. Croix: Hams Bluff, Northside. St. Thomas: Upon the reef connecting this island with the Hurricane Island. St. Jan: Cruz Bay.

Geogr. Distrib.: Bermuda, Mediterranean Sea.

4. **Ceramium nitens** (Ag.) J. Agardh.

J. Agardh, Spec. Alg., vol. II, p. 130; Epicrisis, p. 101.
Ceramium rubrum var. *nitens* C. Agardh, Systema, p. 136.

Ceramium nitens has been found in shallow water and in the sea down to a depth of about 10 meters and in quite sheltered spots as well as in more exposed places.

It is often found upon the roots of the mangroves, upon which it forms rather large tufts, up to 10 cms. or higher. These are fastened to the mangrove roots by means of rhizoids issuing from the lower parts of the filaments. These rhizoids are mostly found together in small tufts. They are rather short and built up of a stalk, composed of some few fairly thickwalled cells, and a small irregularly lobed disc.

Specimens with tetrasporangia only are met with. These occurred in the months of January to March.

This species is rather common on the shores of the islands. At St. Croix it has already been collected by Ravn, Ørsted and others.

Geogr. Distrib.: West Indies.

Fam. 2. ***Rhodomelaceæ.***

Subfam. 1. Laurencieæ.

Laurencia Lamouroux.

The correct definition of the species belonging to this genus according to the material to hand has given me much trouble, and I am afraid that I have not always arrived at a definite result. In order to arrive at an exact definition a comparison with authentic specimens would be necessary, but at present, during the war, this is out of the question. The examination of the original specimens and a revision of the whole genus seems to be very desirable.

Falkenberg, who also points out the difficulties encountered in attempting a definition of the species, in his very valuable work on the Rhodomelaceae, p. 252, gives some starting points from which to proceed to the said definition of the species.

As a chief characteristic he places the radial type opposite to the flat, bilateral. He further quotes the more or less vigorous ramification, especially if the latter is alternate, or shows a more or less marked tendency to become opposite or verticillate. As an example of a species with alternate branching he names *L. papillosa*, as one with verticillate branching *L. obtusa*. Furthermore be mentions as a subcharacteristic the more or less vigorous development of the side-branches, these in some species forming long filaments like the main filament, in others short wart-like ones.

Falkenberg also mentions (l. c., p. 246) the different structure of the antheridial stands, as found in *Laurencia obtusa* and *pinnatifida*, and points out that such differences are perhaps to be found, too, in other species. Unfortunately the antheridial stands are as yet unknown in most of the species.

1. **Laurencia Poitei** (Lamour.) Howe.

Howe, M. A., Phycological studies, II, in Bull. Torr. Bot. Club, vol. 32, 1905, p. 583.

Fucus Poitei Lamour., Dissertations sur plus. espèces de Fucus, Agen 1805, p. 63, tab. 31, figs. 2—3.

Laurencia gemmifera Harv., Nereis Bor.-Am., part II, 1852, p. 73, tab. 18 B.

Laurencia tuberculosa J. Ag., Spec. Alg., vol. II, p. III, 1863, p. 760.

Laurencia mexicana Kütz., Tab. Phycolog., vol. XV, 1865, p. 25, tab. 70, figs. c, d.

The specimens found seem to agree very well with the descriptions and figures of Harvey. It is a relatively large plant, often reaching a length of 15 cm or more. The thallus is rather robust and cartilaginous.

Upon a transverse section the central axis is not very visible, the tissue consisting in the middle of larger, towards the periphery of smaller, roundish cells. The peripheric cells are rather small, in transverse section nearly subquadratic. While most of the specimens had a glabrous surface, some specimens (my collections no. 1504) had the peripheric cells provided with small papillæ (Fig. 235). They were present in the young parts of the thallus, in older parts they seem to disappear. I cannot say

whether we here have to do with a special form, having had so few specimens at my disposal.

As to the ramification, this is very irregular, the branches being of very variable length, some short and some long in no definite order. They are very flexuous and spreading to all sides.

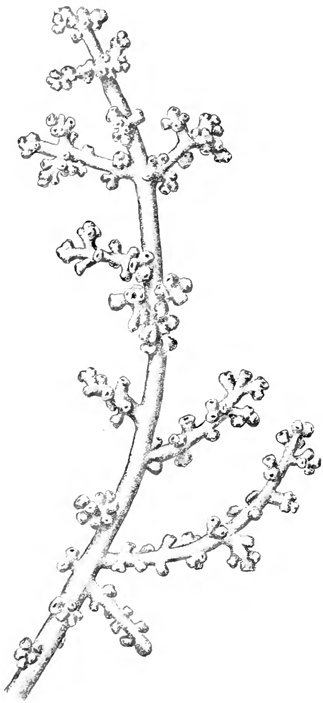


Fig. 234. *Laurencia Poitei* (Lamour.) Howe. Part of the thallus. (About 2 : 1).

The branches bear shorter branchlets most of these being very short, tubercle-like.

Only specimens with tetrasporangia were found; the tetrasporangia are formed in the upper end of the tubercle-like ramuli.

This species is gathered in rather open sea and in fairly deep water, from 5 to 15 fathoms.

St. Croix: off Frederikssted, White Bay and near Buck Island. St. Thomas: In the sea to the West of Water Island. St. Jan: off Annaberg and near Thatchkey Island. According to J. AGARDH, l. c., the plant has already been found at St. Croix (Hb. Hoffman).

Geogr. Distrib.: West Indies.

2. Laurencia papillosa (Forsk.) Grev.

GREVILLE, R. K., Algæ Britannicæ, 1830, p. LII. J. AGARDH, Spec. Alg., vol. II, pars III, p. 756; Epicrisis, p. 652. KÜTZING, Spec. Alg., p. 855; Tab. Phycologicæ, vol. XV, tab. 62.

Fucus papillosus Forsk., Flora Ægypt.-Arab., 1775, p. 190.

Fucus thyrsoides Turner, Fuci, tab. 19.

Chondria papillosa Ag., Spec. Alg., p. 344; Systema, p. 203.

For more synonyms compare DE-TONI, Sylloge Alg., vol. IV, sectio III, p. 789.

When growing in exposed localities this plant reaches only

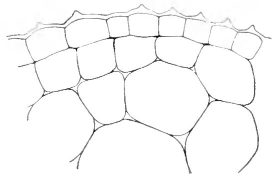


Fig. 235. *Laurencia Poitei* (Lamour.) Howe. Transverse section of the peripheric tissue of the thallus. (About 150:1).

a few cm in height, in somewhat more sheltered places it grows higher, up to 10 cm or even more.

It is firmly fastened to the rocks by means of a broad and rather thick disc, from which several, and often many, erect branches grow up.

Growing as it often does in the most exposed places, the thallus is of a very firm and cartilaginous consistency. The tissue of the plant is also built quite according to its habitat. The epidermal cells, when seen from above, are small, roundish and have very thick walls; upon a transverse section they are found to be long and narrow like palissade cells (Fig. 236). They are about 25 μ long and 8 μ broad. Also the cells in the interior of the thallus have thick walls. The central cylinder is not easily distinguishable. Only plants with tetraspores were found. These are formed in the summit of the wart-like ramuli.

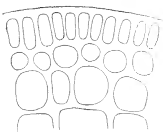


Fig. 236. *Laurencia papillosa* (Forsk.) Grev. Transverse section of peripheric part of thallus. (About 200:1).

It is a common plant along the more open parts of the coast of the islands.

Geogr. Distrib.: Warmer parts of the Atlantic Ocean, Mediterranean Sea, Red Sea, Sandwich Islands etc.

3. **Laurencia obtusa** (Huds.) Lamour.

Lamouroux, J. V. F., Essai in Annales du Muséum d'Hist. Nat., vol. 20, 1813, p. 130. J. Agardh, Spec. Alg., vol. II, p. 3, p. 750; Epicrisis, p. 653. Harvey, Phycologia Brit., pl. 148.

Fucus obtusus Huds. Fl. Angl., p. 586. Turner, D., Fuci, vol. I, tab. 21.

The specimens I refer to this species are very heterogeneous, and it may be that several different forms have been classified together.

What especially characterizes this species is that the ramification has more or less a tendency to be verticillate; this being especially the case in the var. *gelatinosa*.

Most of the specimens referred to this species show upon a transverse section of the young thallus a relatively distinct central cylinder. In older parts of the thallus it is more indistinct or

altogether absent, and the tissue consists then of roundish cells, larger in the middle, smaller outwards.

Some of the specimens were small, often only a few centimeters high. They often grow like low dense tufts, in which other smaller algæ find protection, e. g., *Polysiphonia ferulacea*, *Ceramium etc.*

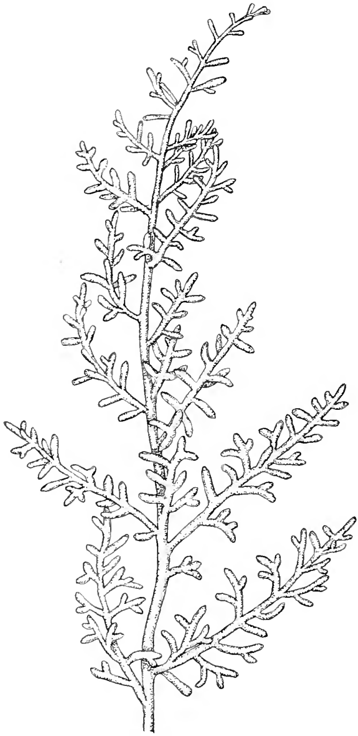


Fig. 237. *Laurencia obtusa* (Huds.) Lamour. Part of the thallus (About 3:1).

Other specimens (Fig. 237) are large, up to 15 cm or even more; they are much like specimens in MAZÉ & SCHRAMM's collection of algæ from Guadeloupe and by these referred to *Laurencia dendroidea.* They have a terete stem. The branches issue on all sides, but with some tendency to be opposite or verticillate. The ramuli are nearly cylindrical or somewhat clavate.

A transverse section of the older part of the thallus shows a tissue consisting of roundish cells of different sizes, without any trace of a central axis. In the young parts of the thallus, on the other hand, this is more clearly visible.

The tetrasporangia are found in the summit of the ramuli.

The cystocarps are placed either upon the ramuli, or upon the branches which bear the ramuli. They are ovate-pyriform in shape, about 230 μ long and 170 μ broad. They open by a large orifice measuring about 60 μ in diameter.

var. *gelatinosa* (Desf.) J. Ag.

J. AGARDH, Spec. Alg., vol. II, p. III, p. 751; Epicrisis, p. 653.

Fucus gelatinosus Desfontaine, Flora Atlantica, Tomus II, Paris Anno 6, p. 427.

Laurencia obtusa var. *crucifera* Kütz. Tabulæ Phycol., vol. XV, p. 20, tab. 55, figs. c—d. HAUCK, Meeresalgen, p. 206.

The specimens (Figs. 238—239) referred to this variety seem to agree very well with the description of DESFONTAINE, and furthermore with HAUCK's variety *crucifera*, to judge by his description and by the figures of KÜTZING, quoted by him. Amongst these figures my plants seem most to resemble the plant which KÜTZING has called *L. cyanosperma* (Tab. phycol. vol. XV, pl. 58). Some of my plants also had a no less striking similarily to a specimen in MAZÉ and SCHRAMM's algæ from Guadeloupe called *Laurencia intricata.*

The specimens found in exposed places are slender and of very firm consistency, while those from more sheltered places are larger, broader and more gelatinous, forming in this way a transition to the typical *Laurencia obtusa.*

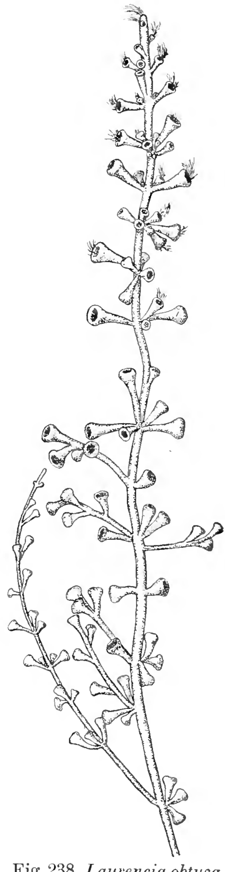


Fig. 238. *Laurencia obtusa* (Huds.) Lamour. var. *gelatinosa* (Desf.) J. Ag. Part of a male plant. (About 3 : 1).

Upon a transverse section of the young parts of the thallus the central axis is in general easily distinguishable (Fig. 240); in one specimen from a very exposed place (my collection no. 1491) the central axis was not visible, the whole tissue being composed, upon a transverse section, of roundish cells, largest in the middle, smaller outwards and all having rather thick walls.

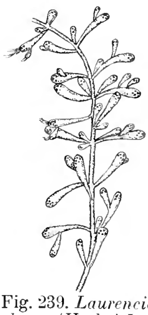


Fig. 239. *Laurencia obtusa* (Huds.) Lamour., var. *gelatinosa* (Desf.) J. Ag. Part of tetrasporic plant. (About 3:1).

My specimens form mostly rather dense tufts, reaching a height of about 10 cm or more. The thallus is slender, pyramidally cylindrical

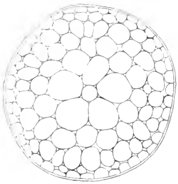


Fig. 240. *Laurencia obtusa* (Huds.) Lamour. var. *gelatinosa* (Desf.) J. Ag. Transverse section of the thallus. (About 60:1).

in shape. The main stem bears on all sides short branches, usually verticillate. The branches ramify again once or several times, the ramuli in the tetrasporic plants being subclavate or nearly cylindrical (Fig. 239). In the male plant, on the other hand, the ramuli are very swollen at their summit (Fig. 238). Female plants were not found. The antheridial stands agree entirely with the description and figures of FALKENBERG, Rhodomelaceen, p. 247, pl. 23, figs. 13—15.

FALKENBERG states that he found at Naples two forms of *Laurencia obtusa* growing together in the same locality. These two forms, in all other points identical, differ from each other by their colour: the one is green, the other yellowish red. COLLINS found the same in Bermuda. This is also seen on the shores of the islands.

This variety is met with even in very exposed places, for instance it is common along the rocky shore of the north-west end of St. Croix. It grows here often somewhat above the level of the sea and is constantly washed by the strong surf nearly always prevailing here.

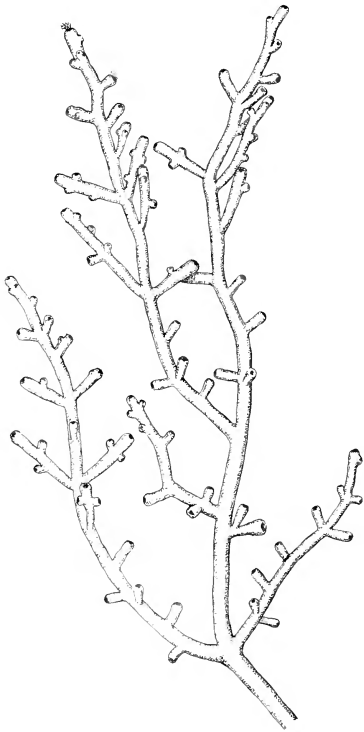


Fig. 241. *Laurencia implicata* J. Ag. Part of the thallus. (About 3:1).

Laurencia obtusa is rather common along the shores of the islands. Var. *gelatinosa* has been found at St. Croix: Northside, Coakley Bay, White

Bay. St. Thomas in the Harbour of Charlotte Amalie; St. Jan: Cruz Bay.

Geogr. Distrib.: Warmer parts of the Atlantic Ocean, Mediterranean Sea.

4. Laurencia implicata J. Ag.

AGARDH, J., Spec. Alg., vol. II, p. III, p. 745; Epicrisis, p. 646. HARVEY, W. H., Nereis Bor.-Am., Part II, p. 72, tab. 18 D.

It is not without hesitation that I have referred a few specimens gathered at St. Croix to this species. In doing so I partly rely on a specimen in MAZÉ and SCHRAMM's collection of algæ from Guadeloupe named *Laurencia implicata*, and partly on the description of J. AGARDH, which seems to me to agree rather well with my specimens; on the other hand these differ somewhat from HARVEY's description and figure, l. c., branching somewhat more regularly on all sides.

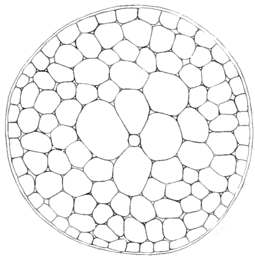


Fig. 242. *Laurencia implicata* J. Ag. Transverse section of the thallus. (About 60:1).

The specimens reach a height of about 16 cm, and have a fine rosy colour.

In a transverse section of the young parts of the thallus (Fig. 242) the central axis is generally rather clearly seen, having a small central cell and commonly five large pericentral cells. The surrounding parenchymatic tissue consists of rather large and thin-walled cells; the peripheric cells are relatively large, about isodiametric in transverse section.

The ramuli are nearly cylindrical or somewhat clavate; they are generally alternate, in some of the specimens with some tendency to be secund. The tetrasporangia are found in the summit of the ramuli.

The specimens were dredged in a depth of about 6 fathoms.

This species is most probably described from specimens from St. Croix, J. AGARDH giving as locality for this species the above named island.

St. Croix: Off Frederikssted; near Buck Island.

Geogr. distrib.: West Indies.

5. **Laurencia chondrioides** nov. spec.

Frons cæspitosa, axibus teretibus, flexuosis, crassitudine variabili, plerumque ca. 350 μ crassis, irregulariter quoqueversum pinnatim ramosis, interdum suboppositis; ramis brevioribus et longioribus intermixtis, intervallo ramorum variabili. Rami minores et ramuli clavati, basi attenuata, apice obtuso.

Tetrasporangia in superiori parte ramulorum apparent; lat tetrasp. = 80 μ.

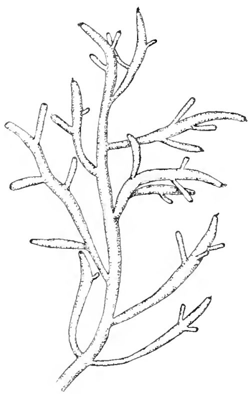


Fig. 243. *Laurencia chondrioides* n. spec. Part of the thallus. (About 6:1).

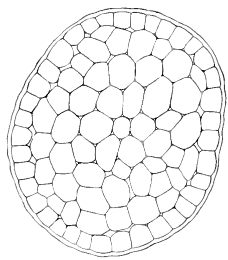


Fig. 244. *Laurencia chondrioides* n. spec. Transverse section of the thallus. (About 100:1).

The plant forms tufts about 6 cm. high. The slender thallus is terete and of variable thickness, often tapering slightly and again increasing several times (Fig. 243).

It is about 350 μ thick.

The ramification is very irregular. The branches issue on all sides sometimes with short, sometimes with long intervals; sometimes they are nearly opposite. Shorter or longer branches occur intermingled.

The branches ramify again once or twice. The smaller branches and the ramuli are narrowed at their base, increasing gradually upwards to above their middle and then tapering slowly to the obtuse summit.

The central axis is fairly distinguishable in the younger parts

of the thallus (Fig. 244), not in the older, the thallus here consisting of roundish, relatively large and thin-walled cells in the middle, smaller ones towards the periphery. Larger and smaller intercellular openings are often present. The peripheric cells are, when seen from above, irregularly polygonal, about 40 μ broad in the young parts of the thallus, in the older subcylindrical or barrelshaped, about 140 μ long and 35 μ broad (Fig. 245). Upon a transverse section they are nearly subquadratic.

The tetrasporangia are formed in the summit of the ramuli (Fig. 246); in the specimens found, however, not in any great number; they are about 80 μ in diameter.

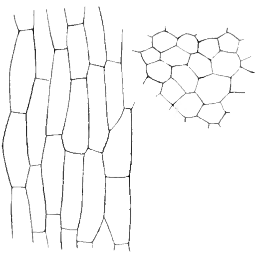


Fig. 245. *Laurencia chondrioides* n. spec. Surface cells of young (to the right) and older (to the left) parts of the thallus. (About 35:1).

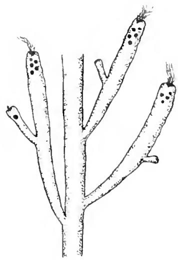


Fig. 246. *Laurencia chondrioides* n. spec. Part of tetrasporic thallus. (About 6:1).

The specific name alludes to the appearance of the dried specimens, the beautiful rosy colour and whole habit of which forcibly recalls some forms of *Chondria dasyphylla*. When compared in more detail several striking differences are noticeable, for instance in *Chondria* the large central cells are clearly seen through the cortical layer, while this is not the case in *Laurencia*. Moreover, transverse sections show the same difference.

This plant has been dredged only in relatively deep water, in a depth of about 30 meter.

Only found once: St. Jan: off America Hill.

6. Laurencia cervicornis Harv.

Harvey, W. H., Nereis Bor. Am., II, p. 73, tab. 18 C.

Collins, Fr. S., The Algae of Bermuda. (Proceed. of the Amer. Academy, vol. LIII, No. 1, 1917, p. 118.)

Of this species I have only found a few specimens. They were dredged in rather deep water and were upon the whole rather poorly developed. When in good condition this plant is very characteristic, and easily known. Its chief peculiarities consist in the very irregular subdichotomous branching, poorer in the basal part, richer in the upper one, the branches on this account being very closely placed at the top, and the whole thallus receiving a roundish outline. The thallus is terete or nearly so, and of about the same size throughout the whole plant.

A transverse section of the thallus shows that the central axis is not very visible, the tissue consisting of roundish thin-walled cells. The epidermal cell-layer is composed of very small and nearly subquadratic cells.

My specimens were sterile. Only dredged once in a depth of about 15 fathoms.

St. Jan: Off Eremitage.

Geogr. Distrib.: West Indies, Florida.

Subfam. 2. Chondrieæ.

Chondria Ag., Harv.

Subgenus I. *Euchondria* Falkenberg.

1. Chondria polyrhiza Collins and Hervey.

Collins, F. S. and A. B. Hervey, The Algæ of Bermuda, p. 121, pl. II, fig. 12. Phycotheca Bor.-Am., No. 2040.

Of this species I have found a single specimen only, and unfortunately it was dried. But it seems to agree quite well with the description of Collins and Hervey.

The plant apparently forms a rather loose tuft, 5 to 6 cm high. The ramification is very irregular, the branches spreading out on all sides, varying greatly in length. There seems to be no main stem. The distance between the branches and ramuli is very variable.

The branches and ramuli are narrowed at their base, tapering upwards evenly into an acute apex. Here some small trichoblasts are found surrounding the conical, protruding growth-point. The peculiar bunched rhizoids are numerous and break out everywhere upon the thallus (Fig. 247). As pointed out by Collins,

they are very like those found in the genus *Herpochondria;* compare FALKENBERG, Rhodomelaceen, p. 218.

The filaments are about 300—400 μ thick. How far the thallus is terete in my plant I have not been able to state, as all my endeavours to make it reassume its original form have been fruitless. The thallus in COLLIN's plant is cylindrical. Compared with the specimen in Phycotheca, my plant is somewhat larger and seems to be more loosely built, more flabby and on the whole of a less firm consistency; the colour, too, is lighter, more rosy red.

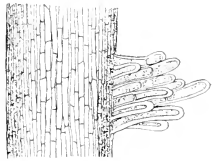


Fig. 247. *Chondria polyrhiza* Collins et Hervey. Part of the thallus with a bundle of rhizoids. (About 90:1).

My specimen is sterile.

The plant was dredged in rather deep water, about 15 fathoms.

St. Jan.: Off Cruz Bay.
Geogr. Distr.: Bermudas.

2. **Chondria atropurpurea** Harv.

HARVEY, W. H., Nereis Boreali-Americana, Part II, 1852, p. 22, pl. 18 E.
Chondriopsis atropurpurea J. Ag., Spec. Alg., vol. II, p. 801; Analecta Algol., 1892, p. 150. FARLOW, The marine Algæ of New England, Washington 1881, p. 167.

Of this species I have found a single specimen only.

This plant is especially characterized by its dark brown-red colour and by its inordinate ramification. The secondary branches are constricted at their base and tapering upwards. The ramuli have nearly the same shape: fusiform.

The specimen found is a male plant. The antheridial stands are placed as usual at the upper end of the ramuli.

It was gathered in the month of January in shallow water in a sheltered locality.

St. Croix: Casavagarden.
Geogr. Distrib.: West Indies, Atlantic shore of the United States, Brazil? Japan?

3. **Chondria littoralis** Harv.

HARVEY, W. H., Nereis Bor.-Am., Part. II, p. 22. FALKENBERG, P., Rhodomelaceen, p. 197.
Chondriopsis littoralis J. Ag., Spec. Alg., vol. II, pars III, p. 800; Analecta algologica, p. 150.

The plant forms dense tufts 14 cm high or more. The main filaments are about $1^{1}/_{2}$ mm thick, tapering gradually upwards. They are divided many times and very irregularly, with long and short intervals between the forking, and often three branches

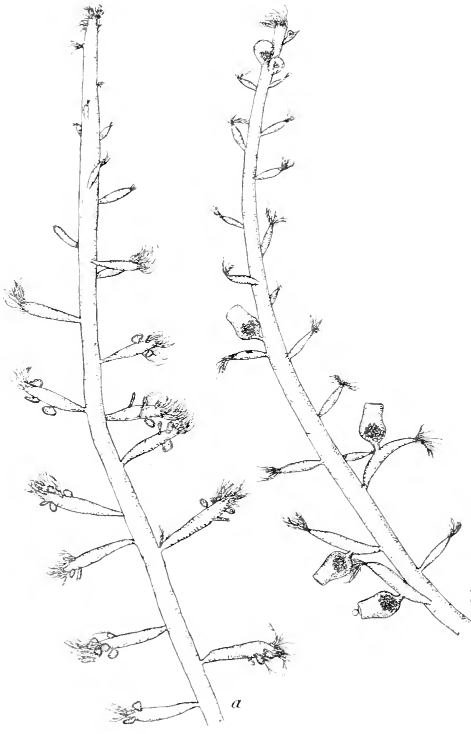


Fig. 248. *Chondria littoralis* Harv. *a*, Part of a male plant. *b*, Part of a female plant. (About 6:1).

issue from the same spot. The main filaments are bare in the basal part, higher up they bear scattered branches of variable length; these and the uppermost ends of the filaments are covered with ramuli spreading on all sides. As these decrease evenly in length upwards, all the uppermost parts of the thallus assume a conical appearance (Fig. 248).

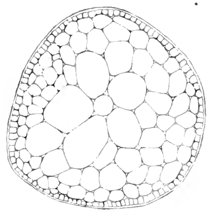


Fig. 249. *Chondria littoralis* Harv. Transverse section of a filament. (About 50:1).

The ramuli are clavate-lanceolate of shape; they increase gradually from the very narrow base until somewhat above their middle, from where they taper slowly towards the acute summit. This is mostly densely covered with trichoblasts.

The thallus is terete. The central cylinder is clearly seen upon a transverse section (Fig. 249), and is surrounded by roundish cells. The peripheric cells are rather small, subquadratic. The growing point protrudes conically and is densely surrounded by trichoblasts.

The tetrasporangia are formed mostly in the summit of the ramuli, sometimes through almost their whole length (Fig. 250); often, too, in the upper end of the branch which bears the ramuli.

The antheridial stands (Fig. 248 *a*) are likewise formed in the upper ends of the ramuli. The diameter of the antheridial stands is about 450 μ long.

The large cystocarps are placed upon the sides of the ramuli (Fig. 248 *b*); sometimes, too, they may occur upon the branch which bears the ramuli. The cystocarps have a short stalk; they are urn-shaped, having a broad, ovate base, and after narrowing upwards, a broad opening. They are about 1,5 mm long and 800 μ broad.

The colour of the plant is a brownish yellow with a reddish tinge.

Compared with the description of Harvey, l. c. my plant shows some minor differences. Thus the cysto-

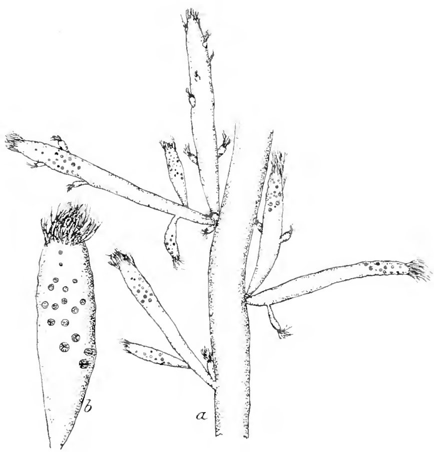


Fig. 250. *Chondria littoralis* Harv. *a*, part of a tetrasporic plant. *b*, a ramulus with tetrasporangia more magnified. (*a*, about 6:1, *b*, about 15:1).

carps in HARVEY's plant are described as "ovate, sessile", in my plant they were urnshaped, short-stalked. Besides, my plant does not seem to reach the dimension mentioned by HARVEY. On the other hand, with regard to the whole habit of the plant, the ramification, colour, etc., both seem very alike, and my plant, too, stains the paper brownish yellow, as HARVEY points out with regard to his specimens.

The plant has been found in shallow water and in rather protected places. It had tetraspores, antheridia and cystocarps in the months of January—March.

It has been found at St. Croix: Lime Tree Bay. St. Jan: Reef Bay.
Geogr. Distrib.: West Indies.

Subgenus 2. *Coelochondria* Falkenb.

4. Chondria dasyphylla (Woodw.) Ag.

AGARDH, C., Spec. Alg., p. 350; Systema, p. 205. HARVEY, W. H., Nereis Bor.-Am. II, p. 20. FALKENBERG, P., Rhodomelaceen, p. 197, pl. 22, figs. 4—18.

Fucus dasyphyllus Woodw. in Transact. Linnean Soc., vol. II, 1794, p. 239, pl. 23, figs. 1—3. English Botany, tab. 847. TURNER, D., Fuci, tab. 22.

Chondriopsis dasyphylla J. Ag., Spec. Alg., II, p. 809; Analecta Algologica, 1892, p. 152.

Laurencia dasyphylla Grev., Algæ Brit. p. 112, pl. 14, figs. 13—17. HARVEY, W. H., Phycol. Brit., pl. 152. KÜTZING, FR., Tab. Phycol., vol. XV., tab. 43.

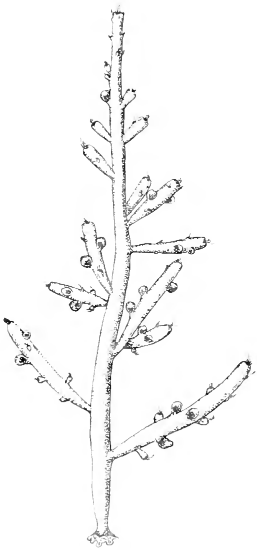


Fig. 251. *Chondria dasyphylla* (Woodw.) Ag. A small female plant. (About 6:1).

Chondria dasyphylla belongs to the subgenus *Coelochondria* in which, as pointed out by FALKENBERG, the growing tip is sunk down and the tissue below it is split, and becomes very loose, with large intervals between the cells.

This plant is fairly common in shallow water and in somewhat sheltered places, as an epiphyte upon *Cymodocea*, *Thalassia* etc. The spe-

cimens found here are small, seldom more than 5 cm. high (Fig. 251).

Plants with tetrasporangia as well as with antheridia and cystocarps are found.

The tetrasporangia (Fig. 252) are formed in the ramuli, mostly in their upper ends, often, however, in $^3/_4$ of their length. The lowest sporangia are the oldest ones. Often, too, the summit of the branch from which the ramuli issue, is sporangiferous. The diameter of the tetrasporangia is about 170 μ.

The antheridial stands are placed in the upper end of the ramuli (Fig. 252), later also upon the summit of the main filament itself.

The cystocarps are placed scattered upon the ramuli and upon the upper end of the main axis (Fig. 251). The cystocarps are ovate — spherical about 1 mm broad and 700 μ high.

Some few larger specimens were dredged in a depth of about 30 meters; these specimens were upon the whole more slenderly built, and the ramuli had only 1—3 cystocarps each.

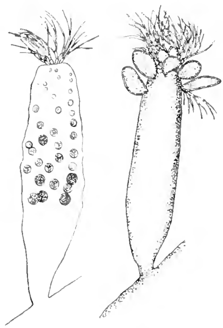


Fig. 252. *Chondria dasyphylla* (Woodw.) Ag. Branchlets with tetrasporangia and antheridial stands (About 12:1).

St. Croix: Behind Long Reef near Christiansted. St. Jan: Off Cruz Bay.

Geogr. Distrib.: Warmer parts of the Atlantic coasts of Europe and America, Mediterranean Sea.

Acanthophora Lamouroux.

1. **Acanthophora spicifera** (Vahl) Borgs.

Børgesen, F., Some new or little known West Indian Florideæ, II (Bot. Tidsskr., 30. Bd. 1910, p. 201).

Fucus spiciferus Vahl, Endeel kryptogamiske Planter fra St. Croix (Skrivter af Naturhistorie-Selskabet, 5. Bd., 2. Hefte, 1802). Esper, Icones Fucorum, 7. Heft, Nürnberg 1808. p. 108, tab. CLIX.

Fucus acanthophorus Lamx., Dissertation sur quelques espèces de Fucus, Agen, An XIII (1805) p. 61, pl. XXX et XXXI, fig. 1.

Acanthophora Thierii Lamx., Essai sur les genres de la famille des Thalassiophytes non articulées, Paris 1813, p. 44. Harvey, Nereis Boreali-Americana, Part II, p. 7, pl. XIV. J. Agardh, Spec. Alg., vol. II, part 3, Lund 1863, p. 819.

Chondria acanthophora C. Ag., Spec. Alg., 1821, p. 363; Systema Algarum, 1824, p. 209.

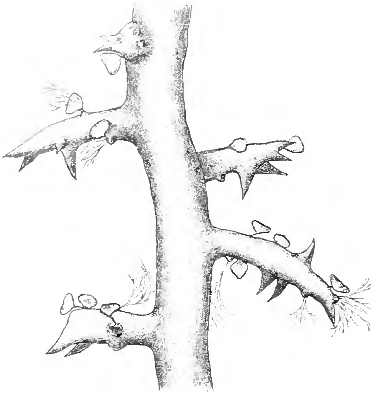


Fig. 253. *Acanthophora spicifera* (Vahl) Børgs. Part of a plant with antheridial stands. (About 10:1).

As pointed out in my paper quoted above, this species ought to have Vahl's old name, being originally described by him from specimens from St. Croix. For further details as to this matter I refer to my paper.

Acanthophora spicifera is fastened to the substratum by means of a large, irregularly lobed disc, from which often many erect filaments issue.

It belongs to the group of species which lack spines upon the main filaments, the branches issuing from these having at their base no spiny branchlets, as is the rule in the other group (comp. Falkenberg, Rhodomelaceen, p. 226). Most of the branches soon stop their growth, becoming short branchlets. But now and then a single one of these branches grows out to filaments with continuous growth, like the main filaments. The branches and branchlets are arranged spirally with a $^1/_4$ divergency upon the filaments. The spines are found mostly in the upper end of the branchlets.

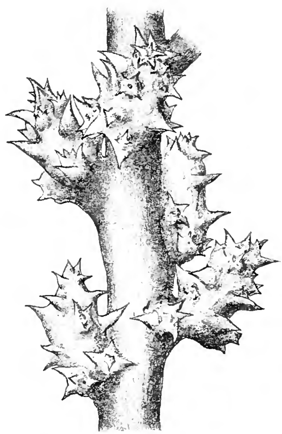


Fig. 254. *Acanthora spicifera* (Vahl) Børgs. Part of a plant with tetrasporangia. (About 10:1).

The branches issue from the basal cell of the trichoblast, just as in the case of *Acanthophora orientalis*, as pointed out by Falkenberg, l. c. p. 231. In fig. 255 the summit of a plant is shown in which a great deal of the trichoblasts covering the summit are taken off. From the basal cells of the trichoblasts we see a young branch issuing, the beginning of the branchlets or branches. It is

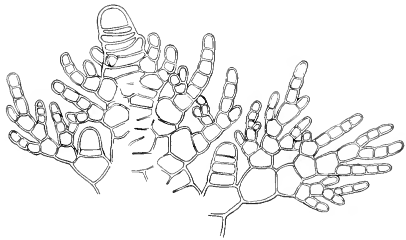


Fig. 255. *Acanthophora spicifera* (Vahl) Børgs. Summit of a filament showing the axillary branches issuing from the basal cell of the trichoblasts. The tissue in the middle has been somewhat spoilt during the preparation. (About 270:1).

further seen from the figure that the summit of the plant is protruding in the form of a pyramid and not "bisweilen einer kleinen Scheitelgrube eingesenkt" as mentioned in ENGLER und PRANTL, Natürl. Pflanzenfam., 1 Teil, Abt. 2, p. 435-6. When in full growth the summit of the plant is quite enveloped and protected by trichoblasts. As the figure shows, the plant has a large apical cell, somewhat longer than broad, from the base of which flat segments are cut off. Each of these segments bears a trichoblast, the basal cells of which are developed before the segments are divided.

A transverse section (Fig. 256) of the stem shows the central cell and the five pericentral ones surrounded by a thick parenchymatic layer of cells, larger and with thin walls inside, small and thickwalled at the periphery.

Plants have been found with tetraspores, antheridia and cystocarps.

The tetraspores are developed in stichidial ramuli provided with spines (Figs. 254, 257*C*), in contrast to the spineless, ovate roundish stichidia of *Acanthophora Delilei* Lamx., as mentioned and described by FALKENBERG, l. c., p. 229, tab. 22, fig. 3. But it is seldom that I have found stichidia in form like those of *Acanthophora Delilei*, in which case there was only a single bare one in the upper end of the filament, the other stichidial branchlets all having spines (comp. fig. 257 *C*).

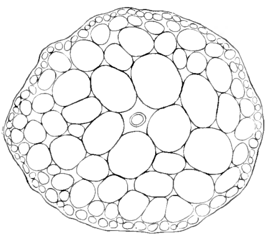


Fig. 256. *Acanthophora spicifera* (Vahl) Børgs. Transverse section of the thallus. (About 50:1).

The stichidial branchlets of the present species are very similar to those of *Acanthophora orientalis* J. Ag. as figured by OKAMURA in "Icones

of Japanese Algæ", vol. I, pl. VIII, figs. 6—7. The tetrasporangia are developed generally in abundance throughout the whole stichidial body, in every case in the short ones, in the longer ones mostly in their upper end; sometimes the tetraspores are also developed in the upper end of the filaments which bear the tetrasporic branchlets.

As I have already remarked, the antheridial stands of the genus *Acanthophora* have only been found in *Acanthophora orientalis.* ASKENASY has described and figured them in "Forschungs-

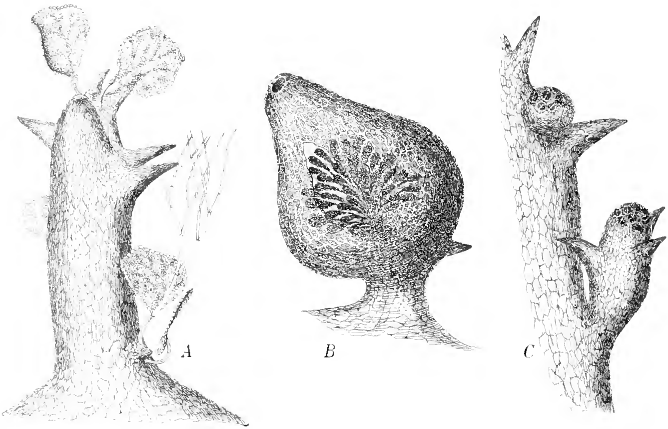


Fig. 257. *Acanthophora spicifera* (Vahl) Borgs. *A*, ramulus with antheridial stand. *B*, a cystocarp. *C*, part of a tetrasporic plant with stichidial ramuli. (About 20 : 1).

reise S. M. S. Gazelle", IV Theil, 1888, Botanik (Algen), p. 48, tab. IX, figs. 11 and 12. In my material of *Acanthophora spicifera* male plants were fairly abundant and the antheridial stands (Figs. 252, 253 *C*) seem to be very similar to those of *Acanthophora orientalis.* The antheridial stands of *Acanthophora* remind one very much of the well-known ones of the genus *Chondria*, so splendidly figured by THURET et BORNET in Études phycologiques, p. 88, pl. 45 and 46.

The antheridial stands are developed from the first side branch of the trichoblast (Fig. 258 *A*), the sterile part of it is commonly very perishable and the fully developed, ripe antheridial stands are therefore placed apparently terminally upon the

shorter or longer basal cell of the trichoblast. The antheridial stand itself is a flat disc-formed body, generally with a rather irregularly formed circumference. The margin is composed of large, oblong, thick-walled, clear cells; inside these both the surfaces are densely covered with the spermatia-forming cells, through which in the middle of the antheridial stand we see a system of filaments ramified subdichotomously in the same plane (Fig. 257 *A*). These filaments FALKENBERG (l. c., p. 201), who has followed the development of the antheridial stands in *Chondria dasyphylla*,

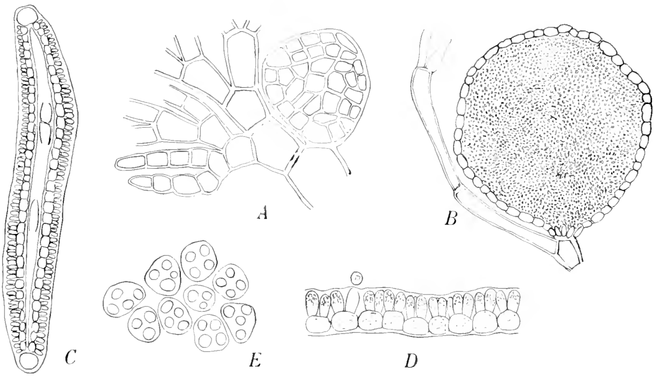


Fig. 258. *Acanthophora spicifera* (Vahl) Borgs. *A*, trichoblast with young antheridial stand. *B*, older antheridial stand. *C*, transverse section of an antheridial stand. *D*, part of the same more magnified. *E*, the same seen from above. (*A*, about 200:1; *B*, 75:1; *C*. 150:1; *D* and *E*, 400:1).

explains as being the central cells and the cells, which bear the spermatia-forming cells as being the pericentral cells. As shown in a transverse section of the antheridial stand (Fig. 258 *C*), cavities are present between the filaments in the interior.

The development of the antheridial stand seems entirely to agree with that of *Chondria* as described by FALKENBERG, l. c., p. 201, pl. 22, figs. 12—14. The ramification of the branch which is destined to be the antheridial stand is made quite in accordance with the sterile part of the trichoblast, only that its branchlets are not free, but connected together. Fig. 258 *A* shows a rather young stage, and fig. 258 *B* shows a fully developed antheridial stand. In Fig. 258 *D* we see a transverse section of the

pericentral cells, and from fig. 258 *E* it is seen that each of these cells bears 3—4 antheridia.

Of cystocarps I have only found some few, of which one is figured in fig. 257 *B*.

This species occurs especially in shallow water and in sheltered places, but it may also be met with in somewhat more open localities. In sheltered places, e. g. in the lagoons, where it is a common and characteristic species in the communities of algæ which grow upon the roots of the mangroves, the form of the plant is more slender, the ramuli are placed at greater intervals and bear fewer spines, and the colour of the plant is often darker. In the lagoons and in sheltered places it often occurs also lying loose upon the bottom, forming entangled masses together with other algæ.

In the more open and exposed localities the plant is more robust.

Acanthophora spicifera has been found with tetraspores. antheridia and cystocarps in the months of January—March.

It is a very common species on the shores of the islands.

Geogr. Distrib.: West Indies, Brazil, Biarritz.

2. Acanthophora muscoides (L.) Bory.

Bory de St. Vincent in Duperrey, Voyage autour du Monde, Botanique, Cryptogamie 1828, p. 156. J. Agardh, Spec. Alg., p. 816. Kützing, Fr., Spec. Alg., p. 859. Tabulæ Phycol. vol. XV, tab. 77. Falkenberg, P., Rhodomelaceen, p. 230. Okamura, Icones. Jap. Alg., vol. I, pl. 8, figs. 8—10.

Fucus muscoides L., Spec. Plant., 1753, p. 1161; 1763, p. 1630.

Chondria muscoides Ag., Spec. Alg., p. 361.

Acanthophora militaris Lamour. Essai Thalassiophytes in Ann. du Muséum, vol. 20, 1813, p. 132.

Acanthophora Delilei Harv., Nereis Bor.-Am., II, p. 18.

The few specimens found are small, about 6—7 cm high. Like the preceding species, the present one is fastened to the substratum by means of a flat disc, from which several erect shoots grow upwards. The ramification is more developed, and the plants form more dense bushes than those of *Acanthophora spicifera*.

Acanthophora muscoides belongs together with *A. Delilei* to the group of species, in which now and then isolated spines are found upon the main stem, and the branches issue from the cor-

ners of the spines as adventitious branches (FALKENBERG, l. c. p. 227). Further the branchlets have mostly spines from their base upwards.

The ramuli with tetrasporangia are very spiny; the tetrasporangia are often found too in the summit of the branchlet which bears the ramuli.

The cystocarps are placed upon a thick spine-like ramulus; FALKENBERG who has followed the development in the case of *A. Delilei* says it is a leaf (l. c., p. 230).

The cystocarps are ovate-urnshaped bodies, with a large opening at their summit.

Only gathered once in shallow water in a somewhat protected locality.

St. Thomas: The Hurricane Island in the harbour of Charlotte Amalia.

Geogr. Distrib.: West Indies, Florida, Brazil, Cape, Japan etc.

Subfam. 3. **Polysiphonieæ.**

Polysiphonia Grev.

As most of the descriptions of the Polysiphonias found in the West Indies and surrounding waters are rather deficient and, without access to original specimens, any precise determination is therefore difficult, I fear that some of my determinations are not quite exact.

The following six species have been found in the area examined; they can be arranged in the following way:

A. With axillary branches.
- *a.* With four pericentral cells.
  - *α.* Diameter of the filaments about 90 μ.
    1. *Polysiphonia havanensis.*
  - *β.* Diameter of the filaments about 35 μ.
    2. *Polysiphonia spec.*
- *b.* With 5—7 pericentral cells.
    3. *Polysiphonia variegata.*

B. Branches formed without connection with the trichoblasts.
- *a.* With four pericentral cells.
  - *α.* Diameter of the erect filaments about 100 μ.
    - I. With nearly spherical cystocarps.
      4. *Polysiphonia sphærospora.*
    - II. Cystocarp urceolate.
      5. *Polysiphonia macrocarpa.*
  - *β.* Diameter of the filaments about 200—300 μ.
    6. *Polysiphonia ferulacea.*

1. Polysiphonia havanensis Mont.

Montagne, J. F. C., Cent. plant. cell. exot. nouv. (Ann. sc. nat., Bot., II. Sér., t. 8, 1837, p. 352). Ramon de la Sagra. Hist nat. Cuba, p. 34, tab. 5, fig. 3. Kützing, Fr., Spec. Alg., p. 818; Tabulæ Phycologicæ, vol. XIII, t. 72, fig. a—d. Harvey, Nereis Bor.-Am., II, p. 34. J. Agardh, Spec. Alg., vol. II, pars III, p. 959.

Fig. 259. *Polysiphonia Havanensis* Mont. Part of filaments with trichoblasts. (About 16:1).

The specimens reach a height of up to 10 cms.

This plant has four pericentral cells, and no cortical layer is present. The branches are formed in connection with the trichoblasts, not exactly in their axils, but pushed somewhat to the side (Fig. 261); they are mostly formed on the left side of the trichoblast (the kathodic side), sometimes too on the right side.

The base consists of creeping filaments; these have thick walls and are often rather torulose, the filaments being thickest at the cross-walls; f. i. one filament was 250 μ at the cross-walls, but only 170 μ in the middle between them (Fig. 260).

The segments in the creeping filaments as well as in the whole plant are of rather variable length, sometimes shorter than their length, sometimes 3—4 times longer than their breadth.

The basal filaments are fixed to the substratum by means of rhizoids breaking out everywhere from the pericentral cells, but mostly near their crosswalls (Fig. 260). The rhizoids have no cross-walls; they have rather thick peripheral walls and end in an irregularly lobed disc. The cylindrical part is about 25 μ thick.

The erect filaments vary much as to their thickness and the length of the segments. Generally the filaments are about 90 μ broad and the length of the cells is about 140 μ, but thinner as well as thicker specimens occur. This varying development of the filaments is due to their different ages, as new adventitious branches are formed continually (Fig. 260). So far as I have seen, these young filaments always seem to be connected with the basal cell of the former trichoblast, or with remains of it.

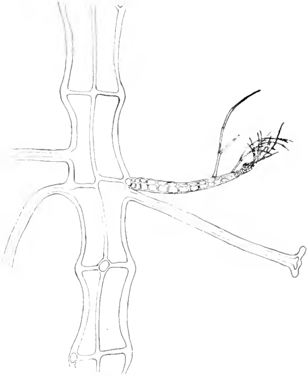


Fig. 260. *Polysiphonia havanensis* Mont. Part of a filament with rhizoids and adventitious branch. (About 50:1).

The trichoblasts are mostly well developed, a single one emerging with a $^1/_4$ divergency from each segment (Fig. 259). They generally cover quite densely the top of the filaments, and are found rather far down upon them.

Most of the specimens are quite sterile; a few specimens only with tetrasporangia are

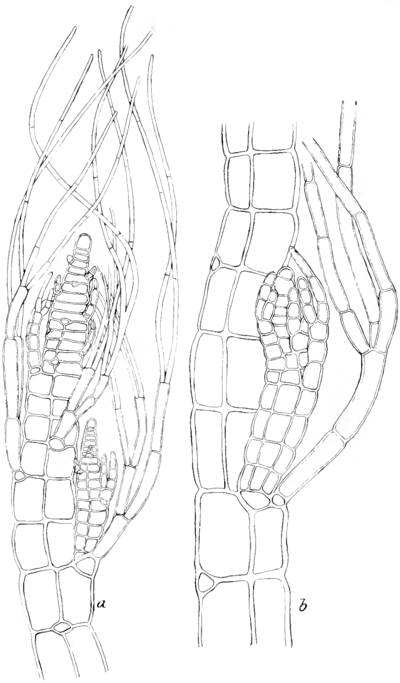


Fig. 261. *Polysiphonia havanensis* Mont. *a*. upper end of a filament with trichoblast and branches; *b*, part of a filament with trichoblast and branch placed at the kathodic side of the trichoblast. (*a*, about 270:1, *b*, about 360:1).

found. The tetrasporangia occur in the upper part of the filaments and are rather scattered, being either solitary or a few together, with sterile segments between. The tetrasporangia are about 70 μ broad.

As I have previously pointed out[1]), this species is found upon the roots of the mangroves in the lagoons; but it occurs also in the sea in deep water, about 8 fathoms or more.

It has already been found at St. Croix by ØRSTED. It seems to be not altogether common on the islands.

St. Croix: Christiansted's Lagoon, Salt River. St. Thomas: Bovini Lagoon. St. Jan: Off America Hill.

Geogr. Distrib.: West Indies. Key West.

2. Polysiphonia spec.

Some small tufts of a quite sterile *Polysiphonia* were found creeping upon old timber. It has four pericentral cells and its branches are developed at the base of the trichoblasts.

The basal part (Fig. 262) of the tufts is formed by decumbent, creeping filaments, composed of rather short cells, the segments being nearly as long as broad, about 50 μ.

Often rhizoids are developed, from every segment, forming in this way a long series (Fig. 262). The rhizoids have no cross walls and end in a small disc fixed to the substratum.

From these basal filaments the erect ones arise. At their base these are of nearly the same size as the basal ones, towards the upper part they taper gradually to about one half of their diameter. The cells have nearly the same length, being about one to one and a half times the breadth of the filaments. In the upper part of the filaments each of the segments carries a trichoblast placed in a spiral line with a $^1/_4$ divergency (Fig. 263).

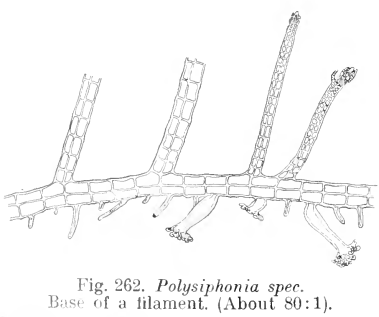


Fig. 262. *Polysiphonia spec.* Base of a filament. (About 80:1).

[1]) BØRGESEN, F. The algal vegetation of the lagoons in the Danish West Indies (Biologiske Arbejder tilegnede EUG. WARMING, Kobenhavn 1911, p. 48).

The branches are placed in the axil of the trichoblast, or more correctly they are pushed a little to the left side of them (Fig. 263).

By its way of growing and whole construction and habit this plant reminds one very much of the preceding species, but being quite sterile it is impossible to give a more exact definition of it.

Found once in shallow water near the shore in Store Nordsidebugt (Magens. Bay), St. Thomas.

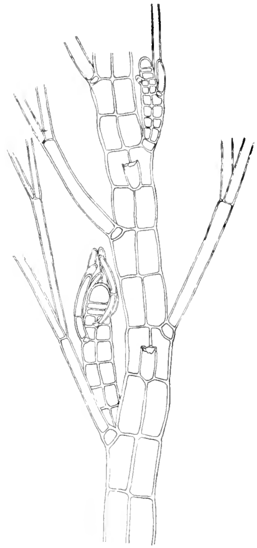


Fig. 263. *Polysiphonia spec.* Part of filament near its summit with trichoblasts and branches. (About 350:1).

3. **Polysiphonia variegata** (Ag.) Zan.

ZANARDINI, G., Synopsis alg. mar. Adriat. in Memorie Real. Accad. d. Torino, Serie II, T. IV, 1842, p. 162. J. AGARDH, Spec. Alg., vol. II, 3, p. 1030; KÜTZING, Spec. Alg., p. 821; Tab. Phycolog., XIII, tab. 81. HARVEY, Phycolog. Brit., pl. 155; Nereis Bor.-Am., part II. p. 45. THURET ET BORNET, Études Phycologiques, p. 86, pl. 42. FALKENBERG, Rhodomelaceen, p. 119, tab. 21, fig. 30. BERTHOLD, Beitr. z. Morphologie und Physiologie der Meeresalgen (Pringsh. Jahrb. 13, pl. XX. fig. 8—15).

Hutchinsia variegata Ag. Systema, p. 153.

Cfr. DE-TONI, Sylloge Alg. Vol. IV. Sect. III, p. 922, ubi syn. pluria.

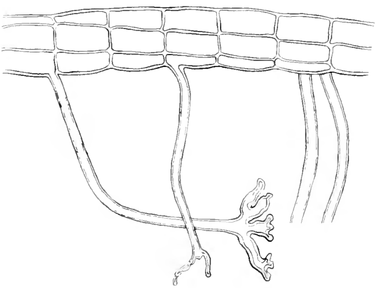


Fig. 264. *Polysiphonia variegata* (Ag.) Zan. Basal part of a filament with rhizoids. (About 260:1).

The plant grows upon the roots of the mangroves and forms dense bushes up to 10 cm or more in height. It is fastened to the substratum by means of numerous rhizoids issuing from the decumbent creeping filaments (Fig. 264). The rhizoids are

as a rule not ramified and end in a small irregularly lobed disc. The rhizoids are separated by a cross wall from the mother pericentral cell. The cylindrical part of the rhizoids is 50 μ thick.

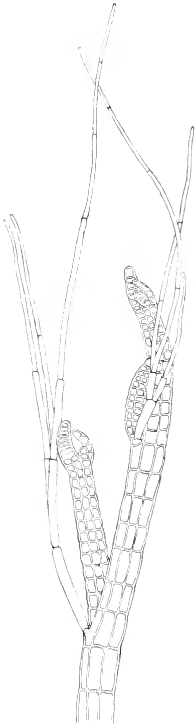


Fig. 265. *Polysiphonia variegata* (Ag.) Zan. Summit of filament with trichoblasts and branches. (About 200 : 1).

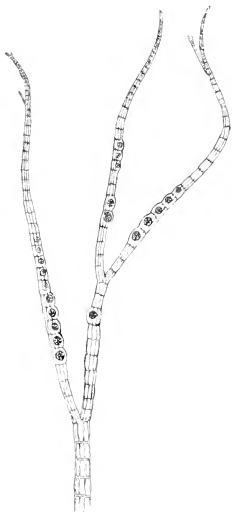


Fig. 266. *Polysiphonia variegata* (Ag. Zan. Part of filament with tetrasporangia. (About 30 : 1).

The plant has commonly 6 pericentral cells, sometimes in the basal part 7 and in the upper part 5 only. No cortical layer was found in my specimens.

The branches (Fig. 265) are found in the axils of the trichoblasts pushed to the left side of them as drawn by FALKENBERG in ENGLER und PRANTL, Nat. Pflanzenfam, I Teil, Abt. 2, p. 439,

fig. 246 E. The distance between the branches is great; as pointed out by FALKENBERG these are most often found upon every fifth to eighth joint.

The tetrasporangia (Fig. 266) are found in the upper part of the branches in shorter or longer rows. The tetrasporangia are proportionately small, and the branches in which they are imbedded are not much swollen. The cystocarps are broadly ovate or nearly spherical and have short stalks.

The antheridia I have not found; these are beautifully figured by THURET in Recherches sur les anthéridies des cryptogames (Ann. sc. nat., Bot., 3. sér., vol. 10, pl. 6) and in Études Phycologiques, l. c.,

This species is a characteristic lagoon-plant living in the often very dirty water found here. Together with other algæ it often forms a dense coating upon the roots of the mangroves, and like these its tufts are more or less covered with mud. In clear water it does not seem to occur. HARVEY, in Phycologia Britannica, pl. 155, has already mentioned this peculiarity, as to its occurrence and this has later on been pointed out by FALKENBERG, Rhodomelaceen, p. 119.

Plants with tetrasporangia and cystocarps have been found in January.

St. Thomas: Bovoni Lagoon. St. Croix: The Lagoon of Christiansted, Salt River Lagoon.

Geogr. Distrib.: The Atlantic coast of North America, the West coast of Europe, Mediterranean Sea.

4. **Polysiphonia sphærocarpa** nov. spec.

Frons dense cæspitosa, cæspitibus parvis, circiter 1—$1^1/_2$ cm altis.

Fila non corticata siphonibus pericentralibus quatuor.

E filis repentibus decumbentibusque, rhizoideis substrato adfixis, fila erecta gignuntur. Fila in parte basali circiter 100 μ crassa; cellulis ca. 150 μ longis.

Ramificatio subdichotoma; ramis erectis extra axillis trichoblastorum ortis, angulis acutis.

Tetrasporangia in superiori parte filorum, sæpe furcata, posita, seriata. Lat. tetrasporangiorum = 60 μ.

Cystocarpia fere sphærica, ca. 80 μ longa et lata.

The plant forms small low tufts about 1—1$^1/_2$ cm high; it was found near the surface of the sea, where is was constantly washed by the waves. It has four pericentral cells (Fig. 267 *b*).

The base consists of creeping decumbent filaments fastened to the substratum by means of rhizoids breaking out from the lowermost cells in the filament, sometimes two from the same cell (Fig. 267 *a*).

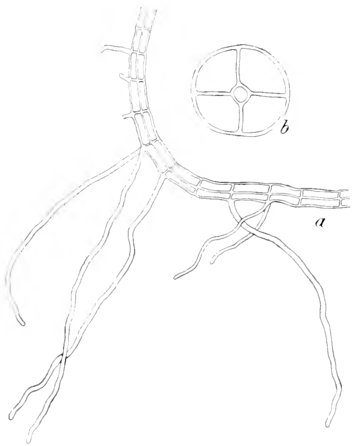


Fig. 267. *Polysiphonia sphærospora* nov. spec. *a*, Base of a filament with rhizoids. *b*. transverse section of a filament. (*a*, about 50:1, *b*, 130:1).

The thicker basal cells are about 150 μ, sometimes up to 200 μ thick and the length of the cells about 125 μ; but these filaments are often much thinner, sometimes not more than 60 μ, and the length of the cells about 100 μ. The creeping filaments bend upwards in their upper end, forming in this way an even transition to the erect filaments (comp. fig. 267 *a*). The latter, too, are often provided with hapters which fix themselves to neighbouring filaments, serving in this way to keep the tuft together.

The erect filaments, whether they issue from the creeping filaments or are the upwardbent summits of these, taper evenly towards their summit. In the basal part they are about 100 μ thick and the cells about 150 μ long; near the summit the filaments are mostly only half as broad as at their base. In the thinner filaments the cells are sometimes three times as long as the diameter of the filament; f. i. a filament was about 60 μ thick and the cells about 175 μ long.

While in the older parts of the thallus the filaments are almost cylindrical, the segments in the young parts are often subsphærical or barrelshaped, and the filaments in this way get a moniliform appearance (Fig. 268).

The branches issue without any connection with the trichoblasts (Fig. 269). The latter are developed upon each seg-

ment or sometimes they are substituted by a branch. The trichoblasts are shed early and are mostly present only at the summit of the filaments. The plant is repeatedly pseudodichotomously ramified. The branches are erect, nearly parallel, issuing at acute angles.

The tetrasporangia (Fig. 270) occur in the upper ends of the filaments, which are often several times forked. They are placed in a spiral line in long series. They are about 60 μ in diameter.

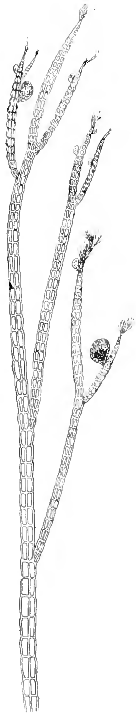


Fig. 268. *Polysiphonia sphærocarpa* nov. spec. Part of a female plant. (About 30:1).

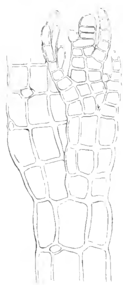


Fig. 269. *Polysiphonia sphærocarpa* nov. spec. Part of filament with branch. (About 260:1).

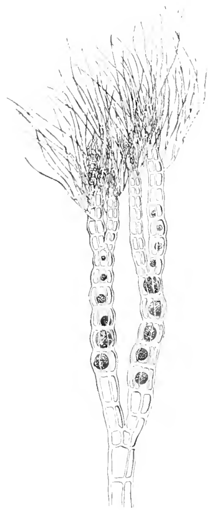


Fig. 270. *Polysiphonia sphærocarpa* nov. spec. Upper end of filament with tetrasporangia. (About 60:1).

The cystocarps (Fig. 271) are nearly spherical, placed upon a short, thick stalk. They are about 80 μ long and of nearly the same breadth.

This plant seems to show much resemblance to *P. ferulacea* but it is in all respects a far more tiny plant. It was

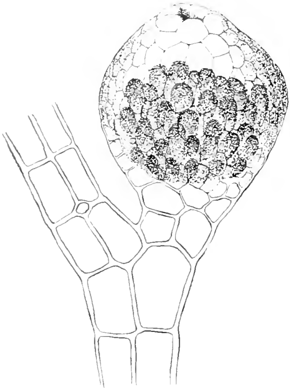


Fig. 271. *Polysiphonia sphærocarpa* nov. spec. A nearly ripe cystocarp. (About 200:1).

found in company with *P. ferulacea.*

Only found once: St. Thomas: Store Nordsidebugt.

5. Polysiphonia macrocarpa Harv.

Harvey, W. H., in Mackay, Flora Hibernica, part 3, Algæ, p. 206. Bornet, E., Les Algues de P. K. A. Schousboe, p. 306, pl. III, fig. 5.

Polysiphonia pulvinata Harv., Phycologia Britannica, pl. 102 B. Kützing, Tabulæ Phycologicæ, vol. 13, pl. 36 a–e?

This plant is common on the roots of the mangrove, and forms dense, dark red-brown tufts, up to 10 cm or higher. The thallus has four pericentral cells. There is no cortical layer. The base (Fig. 272) of the plant consists of decumbent, creeping, more or less ramified filaments, from the lower surface of which rhizoids issue, fastening the filaments to the substratum. The rhizoids grow out from the pericentral cells and are in permanent open connection with the mother-cell, having no walls, either at their point of origin or elsewhere. They have a longer or shorter cylindrical stem with very thick peripheral walls, leaving only a very narrow channel open in the middle, and end in irregular lobes, often forming a small disc. The rhizoids are of variable length, shorter or longer in proportion to the distance from the sub-

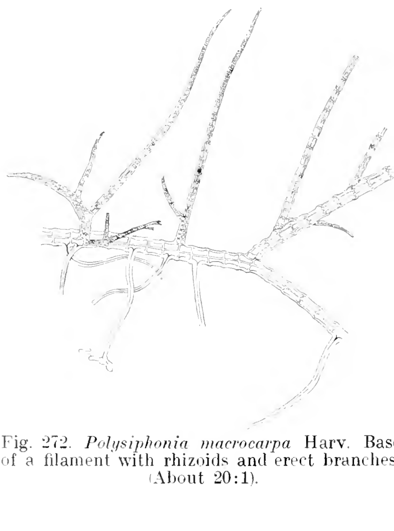


Fig. 272. *Polysiphonia macrocarpa* Harv. Base of a filament with rhizoids and erect branches. (About 20:1).

stratum, mostly about 800 μ long; the cylindrical part is about 40 μ thick.

The creeping filaments have thick walls and sinuated periphery, the filaments being thickest at the cross-walls; the filaments are about 100—150 μ or thicker. The length of the pericentral cells in these filaments varies about 150 μ.

From these creeping filaments the erect ones grow up. The peripheral walls in these are still thick at the base but upwards they soon become thin. The

Fig. 273. *Polysiphonia macrocarpa* Harv. Part of a female plant. (About 16:1).

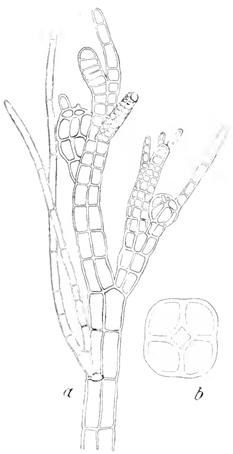


Fig. 274. *Polysiphonia macrocarpa* Harv. *a*, summit of a filament with young cystocarps. *b*, transverse section of a filament. (*a*, about 200:1, *b*, 150:1).

filaments are about 100 μ thick, but both thinner and thicker ones are to be found. The length of the cells in these filaments is rather variable. Generally they are about one and a half to twice as long as they are broad, but often they are three to four times as long or even longer. Upwards the filaments taper gradually and in the upper ends they are only 20—25 μ thick.

The erect filaments are often unbranched at their base. If we examine such a young filament in vigorous growth

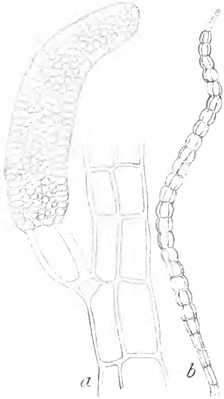


Fig. 275. *Polysiphonia macrocarpa* Harv. *a*, filament with antheridial stand; *b*, upper end of tetrasporic filament (*a*, about 360:1; *b*, about 50:1).

we find it quite destitute of trichoblasts (comp. Fig. 272); it is straight and its diameter increases rather quickly downwards from the small apical cell, which is constantly divided by horizontal walls.

Upwards the filaments are rather richly ramified on all sides. The branches issue without any connection with the trichoblasts (Fig. 274). The distance between the trichoblasts or branches varies considerably, sometimes these issue from each joint, sometimes 1—3 segments are bare.

The trichoblasts are richly developed in some specimens, more sparingly or not at all in others.

The tetrasporangia (Fig. 275 *b*) are found in long rows at the ends of the filaments. These are mostly undivided, sometimes forked. The segments containing the tetrasporangia are spherically swollen, about 80 μ broad.

The antheridial stands of the *Polysiphonias* are, as is well known, formed by the trichoblasts, and with regard to these organs the present *Polysiphonia* belongs to the group of species (e. g. *atrorubescens*, *fastigiata*, *scopulorum* etc.)*) in which the whole trichoblast is transformed, not having even a sterile end, as is for example the case in *Polysiphonia urceolata***). They (Fig 275 *a*) are cylindrical in shape, with an obtuse apex, about 400—500 μ long and 100—110 μ broad. The pedicel bearing the antheridial stand consists of two cells, the short basal cell always found in the trichoblasts, and a longer cylindrical one.

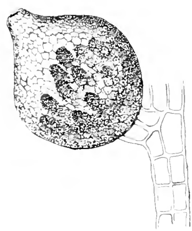


Fig. 276. *Polysiphonia macrocarpa* Harv. A nearly ripe cystocarp. (About 70:1).

The cystocarps originate from the second cell of the trichoblast, as is commonly the

*) Cfr. Thuret et Bornet, Études phycologiques, p. 86.

**) Cfr. Rosenvinge. L. Kolderup, Sur les organes piliformes des Rhodomelacées (Overs. k. danske Vidensk. Selsk. Forhandl. 1903, p. 450, fig. 2).

case in *Polysiphonia**). When fully developed they are urceolate in shape (Figs. 273, 276), with a broadly hemispherical base tapering gradually upwards, the apex prolonged into a rather long neck. They are about 250 μ long and 190 μ broad. As to their shape they agree very well with KÜTZING's figure, l. c., fig. c.

This plant is evidently in several respects nearly related to *P. sertularioides***) but this species has branches in the axils of the trichoblasts as described by KNY***) and FALKENBERG, l. c., p. 122, pl. I, figs. 1—16, so that *Polysiphonia macrocarpa*, owing to the lack of axillary branches, (provided that my plant is rightly referred to this species) is easily separated from it.

It has been found with tetraspores, antheridia and cystocarps in the months of January and February.

St. Croix: Christiansted's Lagoon, Salt River, Krause's Lagoon. St. Thomas: Bovoni Lagoon. St. Jan: Coral Bay.

Geogr. Distrib.: Atlantic coast of Europe and Africa from Great Britain to Morocco. West Indies.

6. **Polysiphonia ferulacea** Suhr, J. Ag.

J. AGARDH, Spec. Alg., vol. II, pars III, p. 980.

Polysiphonia breviarticulata Harv., Nereis Bor.-Am., p. 36, tab. XVI B.

This plant was found growing among other algæ forming, together with these, entangled masses. It is a very coarse and robust plant.

It has creeping basal filaments (Fig. 277 *a*) fastened to the surrounding algæ by means of numerous hapters. The hapters are commonly short, but vigorous, with thick walls, and end in a small lobed disc. The diameter of the cylindrical stem of the rhizoids often reaches a length of more than 100 μ. The basal filaments are about 300 μ thick, sometimes even 400 μ or more. The peripheral walls are very thick (lat. about 8 μ); also the walls between the cells are proportionally substantial. The cells are about 130 μ broad and 100 μ long. The hapters often issue in pairs side to side, a single one from each of the pericentral cells below.

On their upper side these filaments carry the erect branches

*) Comp. ROSENVINGE, L. KOLDERUP, Bidrag til Polysiphonias Morfologi, Bot. Tidsskr., Bd. 14, 1884, p. 23.

**) Cfr. BORNET, Ed. Les Algues de P. K. A. SCHOUSBOE, p. 306. In Sylloge DE-TONI has *P. macrocarpa* as merely a synonym of *P. sertularioides*.

***) KNY, L., Über Axillarknospen bei Florideen, p. 105, pl. II, figs. 1—4.

(Fig. 277 *c*). These are about 200—250 μ thick, and the cells are nearly quadratic, mostly somewhat shorter than long, about 100 μ broad and 85 μ long.

The erect branches are ramified on all sides. The branches grow out to filaments like the mother branch, some of them shorter, some longer. Rhizoids may issue from every cell in the filaments, by means of which they attach themselves to the neighbouring plants

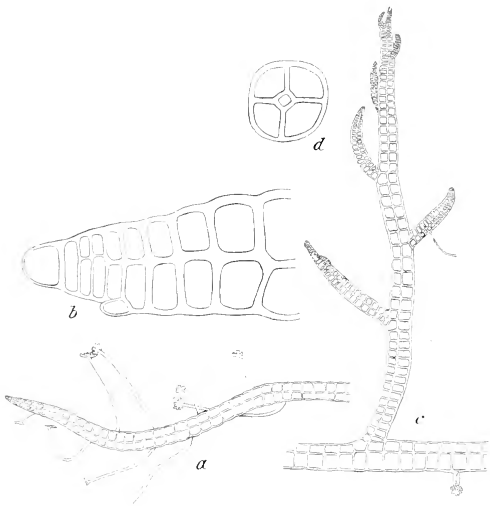


Fig. 277. *Polysiphonia ferulacea* Suhr, J. Ag.
a, base of a plant. *b*, summit of the same basal filament. *c*, basal filament with erect filament. *d*, transverse section of a filament.
(*a*, about 20:1; *b*, 250:1; *c*, 20:1; *d*, 60:1).

or other substratum, and when so attached new erect filaments may issue from them.

The branches are produced without any connection with the trichoblast (Fig. 278 *a*). The last mentioned are copiously developed and generally quite cover the upper end of the filaments, but they are not very persistent and drop early. A trichoblast is developed upon each segment with a $^1/_4$ divergency.

The tetrasporangia occur in the summit of the filaments in long rows, a single one in each segment forming together a screw (Fig. 278 *b*). The tetrasporangia are about 60 μ thick.

The antheridial stands (Fig. 279) are formed by the first side-branch of the trichoblast. They are rather thick, subcylindrical, with a nearly spherical, thick-walled, sterile, apical cell; sometimes two are found. The fertile part is up to 200 μ long and 60 μ broad. The fertile trichoblasts are found in the summit of the filaments. The antheridial plants are somewhat more slender than those with

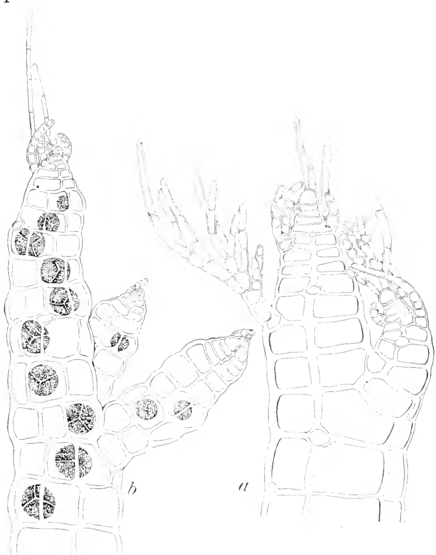


Fig. 278. *Polysiphonia ferulacea* Suhr, J. Ag.
a, summit of a filament; of some of the trichoblasts the basal cell is drawn only. *b*, summit of a plant with tetrasporangia.
(About 180:1).

tetrasporangia and cystocarps, the diameter of the vegetative filament reaching only about 150 μ—200 μ.

The cystocarps (Fig. 280) are large, nearly spherical, with a short stalk. They are about 350 μ long and broad.

I have compared my plants with specimens belonging to the Botanical Museum, Copenhagen, collected by Liebman at Vera Cruz and determined by J. Agardh. Agardh had at first referred these specimens to *Polysiphonia breviarticulata* but in Species Algarum, vol. II, pars III, p. 981, he alters this determination and refers Liebman's plant to *P. ferulacea.*

My specimens agree in the main with the Mexican plant, only they are much more vigorously and robustly developed. The Mexican plant has more slender filaments and, moreover a taller thallus than mine, and agrees better with HARVEY's figure (l. c.).

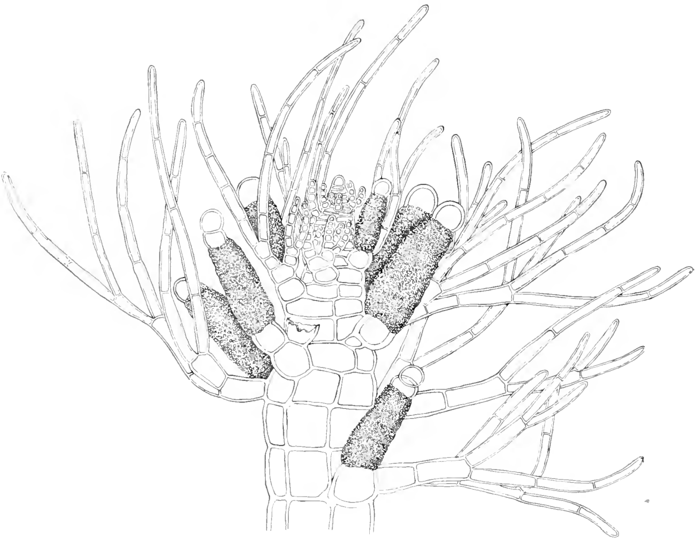


Fig. 279. *Polysiphonia ferulacea* Suhr, J. Ag.
Summit of a plant with antheridial stands. (About 125:1).

That the specimens collected by me are so robustly developed is most probably due to the exposed places in which they grew. Thus they were found upon the coral reef connecting the Hurricane Island with St. Thomas, a locality, and the peculiar algal vegetation of which I have mentioned earlier*). *P. ferulacea* forms here, together with *Caulerpa racemosa*, f. *reducta*, *Cladophoropsis membranacea* and a few other algæ, low, compact patches which are all the more strongly felted together inasmuch as most of these algæ occurring here are able to develop haptera from nearly every

*) BORGESEN, F., An ecological and systematic account of the Caulerpas of the Danish West Indies (Kgl. danske Vidensk. Selsk. Skrifter, 7. Rk. Naturv.-Mathem. Afd. IV, 5, 1907, p. 346).

part of their thallus, this also being the case with *P. ferulacea* as mentioned above.

St. Thomas: The reef between the Hurricane Island and St. Thomas. Store Nordsidebugt. St. Croix: Northside.

Geogr. Distrib.: Mexico, West Indies, Australia. Sandwich Islands.

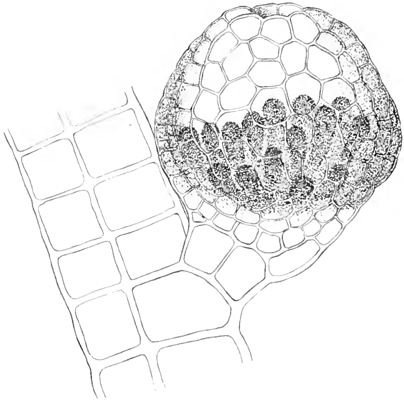


Fig. 280. *Polysiphonia ferulacea* Suhr, J. Ag. Part of a filament with a nearly ripe cystocarp. (About 125:1).

Digenia Ag.

1. Digenia simplex (Wulf.) Ag.

AGARDH, C., Spec. Alg., p. 389. Syst. p. 194. J. AGARDH, Alg. Medit., p. 147; Spec. Alg., vol. II, pars 3, p. 845. HARVEY, W. H., Nereis Bor.-Am., part II, p. 30. FALKENBERG, P., Rhodomelaceen, p. 159, pl. 9, figs. 25–29.

Conferva simplex Wulf., Cryptogama Aquatica, p. 17.

Cfr. DE-TONI, Sylloge Alg., vol. IV, p. III, p. 963, where more synonyms are named.

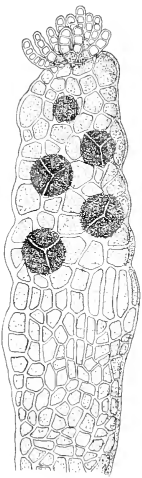


Fig. 281. *Digenia simplex* (Wulf.) Upper end of branch with tetrasporangia. (About 125:1).

Regarding its anatomy and morphological building upon the whole I refer to FALKENBERG's exhaustive description l. c.

Digenia simplex occurs both in shallow water and rather exposed places and in deep water. The different localities determine to a large extent the development of the plant; in the first mentioned places the plant is robust, of low growth, about 5—6 cm high and much ramified, in deep water on the other hand I have gathered specimens about 20 cm high and nearly unbranched.

Its stiff, tough stem is a very attractive growing place for numerous small algæ which commonly cover its thallus to such an extent that only the quite young tips are free.

Specimens with tetrasporangia were found. The tetrasporangia occur in the upper end of the branchlets with definite growth. These grow thicker in the fertile part, the whole branchlet assuming thereby a clavate appearance (Fig. 281). The tetrasporangia are placed in screws, one in each segment. They are about 80 μ in diameter. The specimens with these organs were gathered in January and February.

As mentioned above this plant is gathered both in shallow water and in deep water down to a depth of about 30 meters.

It is a rather common species along the shores of the islands.

Geogr. Distrib.: Seems to occur in nearly all warm seas.

Bryothamnion Kütz.

1. Bryothamnion triquetrum (Gmel.) Howe.

Howe, M. A., in Journal of the New York Bot. Garden, vol. XVI, 1915, p. 222.

Bryothamnion triangulare Kütz., Spec. Alg., p. 842. J. Agardh, Spec. Alg., vol. II, p. III, p. 850. Falkenberg, Rhodomelaceen, p. 172, tab. 19, figs. 32—33.

Fucus triqueter S. G. Gmelin, Historia Fucorum, 1768, p. 122, tab. 8, fig. 4.

Fucus triangularis J. F. Gmelin in Linné, Syst. Naturæ, Editio 13, p. 1383. Turner, Fuci, tab. 33.

Alsidium triangulare J. Ag. in Linnæa, vol. XV, 1841, p. 28. Harvey, W. H., Nereis Bor.-Am., Part II, p. 15, tab. XIII. A.

As pointed out by Falkenberg it is rather difficult to extract the summit with the young growing point of this plant from the surrounding branchlets which quite cover it, but after some attempts I succeeded in removing one, of which the accompanying drawing is a copy. This agrees well with Falkenberg's description. From the cup-shaped top-cell disc-formed segments are gradually cut off, which afterwards again are divided by vertical walls. From every second segment a trichoblast is developed. The trichoblasts are placed in a screw line with a divergency of $^1/_3$; in fig. 282 the uppermost tips of the trichoblast marked 4 are seen only, as this trichoblast stands behind the main axis and branch 5.

The trichoblasts are rather poorly developed, only forked once above the basal cell, and the two filaments, when fully developed, consist of 4 cells only; the nethermost cells are cylindrical—barrelshaped, the uppermost short, subspherical; the diameter of

the cells is about 12 μ long; they have rather thick walls. Upon the branchlets the trichoblasts are much smaller, the filaments above the forking consisting of a single cell only. In his plant FALKENBERG did not find more than two to three cells in the filaments of the trichoblasts.

From the basal segment of each trichoblast a branch is developed. As is pointed out by FALKENBERG this is placed quite, or very nearly in the manner of an axillary branch. These axillary branches increase very quickly and assume at an early stage the cartilaginous consistency of the whole thallus. When young they are inwardly bent, sheltering the summit of the plant. The trichoblasts are shed early and leave no scars, their place being quite effaced by the cortical layer which is most abundantly developed just at the base of the branches. Most of these branches, after having reached a certain length, stop their development and become the spiny branchlets characteristic of this species (Fig. 283). Now and then one of these branchlets assumes continuous growth and grows out like the main filaments.

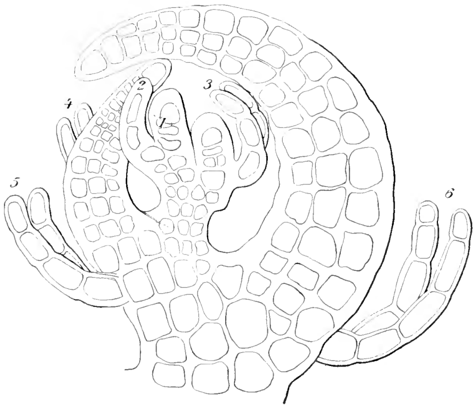


Fig. 282. *Bryothamnion triquetrum* (Gmel.) Harv. *1—6*, successive generations of branches and trichoblasts. The cells in the basal part are brought somewhat in disorder by the preparation and the branches and trichoblasts, also, are not quite in their exact place. (About 330:1).

The ramification of the branchlets takes place quite in the same manner with the exception only that, as mentioned above, the growth is soon stopped.

My material contained sterile plants only.

Bryothamnion triquetrum is fairly common in shallow water in sheltered as well as somewhat exposed places; sometimes it grows in rather large societies. Further it is also dredged in

Fig. 283. *Bryothamnion triquetrum* (Gmel.) Howe. Part of a plant. (About 3:1).

rather deep water at a depth of 20 meters or more. The plants taken from deep water are slender and are not much ramified, those from shallow water are more robust and richly ramified.

This species is rather common along the shores of the islands.

Geogr. Distrib.: West Indies, Brazil, Atlantic coast of Africa.

Bryothamnion Seaforthii (Turn.) Kütz.

KÜTZING, Phycologia gener., p. 433, tab. 52, fig. 11; Spec. Alg., p. 842. AGARDH, J., Spec. Alg., vol. II, pars III, p. 848. FALKENBERG, P., Rhodomelaceen, p. 174, tab. 19, fig. 34.

Fucus Seaforthii Turner, Fuci, pl. 190. *Thamnophora ? Seaforthii* Ag., Spec. Alg., p. 227. System., p. 240. *Montagne* in Ramon de la Sagra, Hist. Cuba, Bot., p. 56, pl. V, fig. 1.

Alsidium Seaforthii J. Ag. in Linnæa, vol. 15, 1841, p. 28.

Cfr. DE-TONI, Sylloge Algarum. vol. IV. p. 975, where more synonyms are named.

The specimens found are all distichous. I have not seen any specimen like forma *imbricata* J. Ag.

Regarding the development of the thallus FALKENBERG describes it as follows: "Haupt- und Seitensprosse produciren, so viel ich gesehen habe, nur unmittelbar vor ihrem Erlöschen schraubig gestellte Blätter ohne Achselsprosse; die Seitensprosse ihrerseits scheinen stets ohne vorhergehendes Tragblatt zu entstehen, so dass bei den zwei-

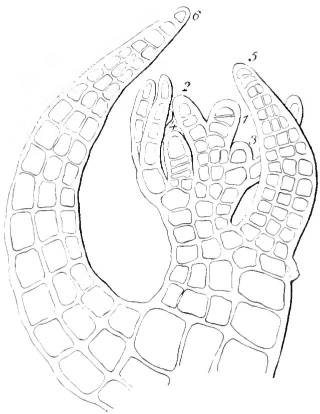


Fig. 284. *Bryothamnion Seaforthii* (Turn.) Kütz. *1–6*, successive generations of branches and trichoblasts; at *1* the first segment of the main stem just begins to grow out; *2*, shows a young trichoblast; *3* and *4*, trichoblasts with axillary branches; at the base of branch *5* the scar of the trichoblast is seen. (About 300:1).

fellosen generischen Zusammenhörigkeit mit *B. triangulare* angenommen werden muss, dass die schwach entwickelten Blätter von *B. triangulare* hier grösstentheils ganz abortirt sind. Häufig abortiren übrigens selbst die Blätter an den erlöschenden Spross-Spitzen mehr oder weniger." This has not been altogether confirmed by the examination of my material.

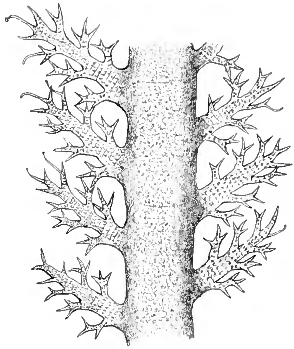


Fig. 285. *Bryothamnion Seaforthii* (Turn.) Kütz. Part of the thallus. (About 4 : 1).

The figure 284 shows the growing summit removed from the surrounding protecting branchlets. From this it is evident that the growth of *Bryothamnion Seaforthii* takes place in a very similar way to that of *Bryothamnion triquetrum.* As in this species, trichoblasts issue from every second segment; the trichoblasts are once forked, each of the filaments consisting of 4 cells, and are upon the whole much like those found in *Br. triquetrum*; the only difference seems to be that the cells are much shorter. On the other hand their diameter is somewhat longer, about 20 μ; sometimes one of the filaments bears a short sidebranch. But while in *Bryothamnion triquetrum* the trichoblasts are placed in a screw line round the summit with a divergency of 120, in the present species they are placed distichously with a divergency of 180°. From the basal cells of each of the trichoblasts an axillary branch issues. These branches grow quickly and are bent inwards over the young summit. I can not say how far the trichoblasts are placed exactly with a divergency of 180° or some smaller variations are to be found; in every case some small oscillations seem to be present as the branches alternately place their summits over or under the following branch.

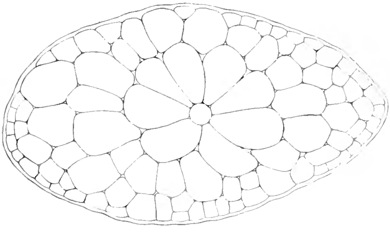


Fig. 286. *Bryothamnion Seaforthii* (Turn.) Kütz. Transverse section of the thallus. (About 30 : 1).

Most of the branches soon stop their growth and become short spiny branchlets (Fig. 285), a few assume continuous growth like the main filament. As pointed out by FALKENBERG the short branchlets grow somewhat longer than those of *Bryothamnion triquetrum*; they have generally from four to six side-branches, and the nethermost are again ramified, having three to four spiny ramuli, while the uppermost are reduced to spines.

At the ends of these spinelike branchlets, in any case in the younger part of the plant, we find a few trichoblasts. These are often considerably developed, being dichotomously ramified several times. As all the filaments in these trichoblasts are erect and run together, nearly parallel, they form a rather dense bush. One of the largest trichoblasts I have seen had in the basal part cells about 35 μ thick. These cells were nearly spherical in shape, being much narrowed at the cross wall; the cells taper evenly upwards towards the summit of the filaments, the uppermost were only 6—7 μ thick. A transverse section of the thallus shows 8—9 pericentral cells with a thick parenchymatic tissue on both sides (Fig. 286).

The material gathered was quite sterile.

This plant was dredged in rather deep water about 30 meters. A single specimen was found washed ashore.

It seems not to be common on the shores of the islands.

St. Jan: Off Annaberg and off America Hill. St. Thomas: Near Thatch Cay. St. Croix: Sandy Point (washed ashore).

Geogr. Distrib.: West Indies, Mexico, Brazil; coast of Guinea.

Subfam. 4. Herposiphonieae.

Herposiphonia Nägl.

1. **Herposiphonia tenella** (C. Ag.) Nägl.

NAGELI, C., Herposiphonia (in SCHLEIDEN und NÄGELI, Zeitschrift für wissenschaftl. Botanik, 3/4. Heft, Zürich 1846, p. 238, tab. VIII.). AMBRONN, H., in Bot. Zeitung, 1880, p. 197, pl. IV. FALKENBERG, P., Rhodomelaceen, p. 304.

Hutchinsia tenella Ag., Spec. Alg., vol. II, p. 105.

Polysiphonia tenella J. Ag., Algæ Mediter., p. 123; Spec. Alg., vol. II, p. III, p. 919.

In describing the plant I at first refer to specimens collected at St. Croix. These specimens (cfr. Fig. 287) seem in all essentials to agree with the descriptions of AMBRONN and FALKENBERG.

As is well known, the plant has a decumbent, creeping main stem, in my specimens with for the most part nine to ten pericentral cells (Fig. 288 *b*). The length of the diameter of the stem is somewhat variable, about 170 μ long, and the length of the segments about 350 μ.

There is no cortical layer to be found.

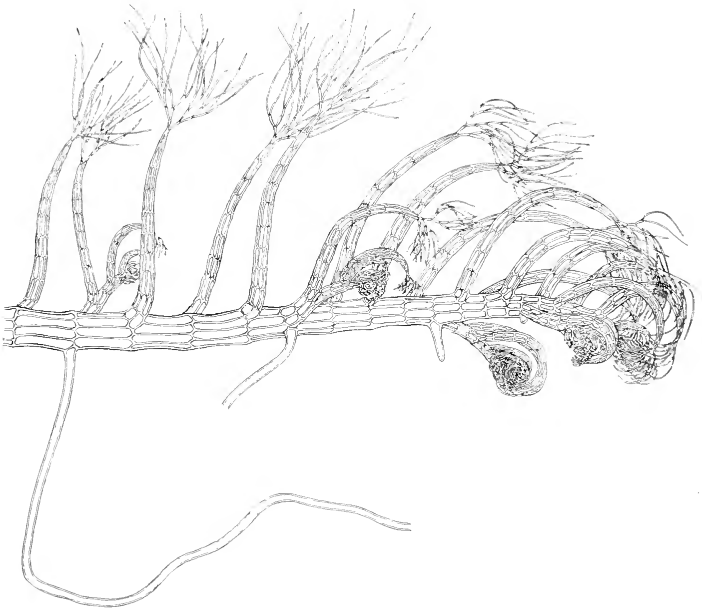


Fig. 287. *Herposiphonia tenella* (C. Ag.) Nägl. Part of a plant. (About 30:1).

The young summit of the stem is curved upwards and inwards, turning its convex side to the substratum. The longitudinal growth is procured by means of an apical cell from which segments are cut off. From these even before they are divided the branches or branchlets begin to grow out; then the segments are divided in the central and pericentral cells. Falkenberg gives fine illustrations of the division of the summit (l. c., pl. III, figs. 14, 15). From the pericentral cells on the ventral side of the stem a row

of rhizoids break out (comp. fig. 287). They issue from the foremost end of each cell. These rhizoids are often of considerable length, up to 1 mm or more, but seldom ramified. They have no walls and do not generally end in a disc. Only a few have been found with a rather irregular disc, like those described by AMBRONN, l. c., p. 211. From the mother-cell the rhizoids are separated by an oblique wall. The cylindrical stem of the rhizoids is about 30 μ thick.

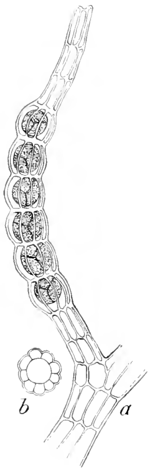


Fig. 288. *Herposiphonia tenella* (C. Ag.) Nägl. *a*, branchlet with tetrasporangia. *b*, transverse section of the thallus. (*a*, about 90:1; *b*, about 80:1).

Upon the dorsal side, the main stem bears two kinds of branches, some with indefinite growth able to grow out to a main filament like the mother stem, and some with limited growth. In the following we may call them respectively branches and branchlets.

The branches with continuous growth are placed alternately on both sides of the main stem, one upon each segment, and in such a way that there in the typical form are always three segments between those bearing the branches (Fig. 287).

Upon the upper dorsal side of these three segments the branchlets with definite growth issue. These are placed singly, that is, a single one upon each segment, in two rows and in such a way that after each branch with continuous growth a branchlet is developed from the opposite side of the stem; if this branch is found on the left side of the stem, the following branchlet is placed on its right side, the next one is then found on the left side and the third again to the right, then follows a branch on the right side and so on. AMBRONN, l. c., pl. IV, fig. 17 and FALKENBERG, l. c., p. 303 have given clear diagrams of the arrangement of the branches and branchlets.

At first the branchlets are much more developed than the young branches. The young branchlets are much curved in the opposite direction to that of the summit of the main stem, bending down over the latter as a protecting cover (comp. fig. 287).

The branchlets are never ramified; at their base they have but few pericentral cells (4—5, comp. 288 *a*), upwards the number

of these soon increases in the following segment, until the same number is reached as found in the main stem. The number of segments in each branchlet seems to vary considerably; in my plants the branchlets are rather short, having only 10—13 segments. AMBRONN on the other hand (l. c., p. 211) has found up to 40 in each branchlet. The segments in my plants were about 60 μ long and the diameter of the branchlet about 45 μ. The length of the whole branchlet was about 1 mm.

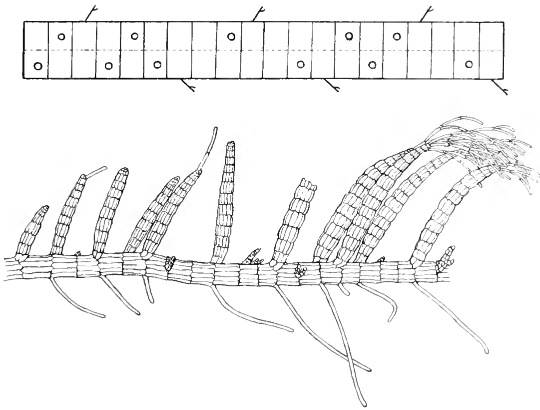


Fig. 289. *Herposiphonia tenella* (C. Ag.) Nägl. Part of a plant with irregular ramification and a scheme of it seen from above. (About 30:1).

The branchlets bear in their summit two trichoblasts, or rarely only a single one; the development of these is given by AMBRONN (l. c., p. 214—5, pl. IV, fig. 15).

Only plants with tetrasporangia were found. These (Fig. 288 *a*) are developed in the branchlets, a single one in each segment, and, in my specimens, seldom more than 6 in each branchlet, while FALKENBERG has found up to 20—30 sporangia in each branchlet. Owing to this fact and in general owing to the very few segments found in the branchlets, my specimens approach *Herposiphonia secunda* (comp. FALKENBERG, l. c., p. 308) and this is still more the case with regard to some other specimens found on the shore of St. Jan.

Here a form was found with very short segments (Fig. 289), and as it also showed some irregularities in the arrangement

of the branches and branchlets, I at first took it for *Herposiphonia secunda.* But after having examined it in more detail I have arrived at the conclusion that it is nothing else than a form of *H. tenella.*

The figure (Fig. 289) shows a part of this plant.

Quite a peculiar feature of this plant was to be found in the facts that the ordinary number of segments between the branches were not maintained, that the branchlets were wanting in some segments, leaving the latter bare, and finally that the branches were often quite rudimentary. This is clearly seen in the diagram of the same part of the plant as shown in Fig. 289.

Beginning from the left end of the figure we at first have a branchlet on the right side and one on the left, then a rudimentary branch on the same side; then follow three segments with branchlets and one with a branch placed quite in accordance with typical *H. tenella.* But then we have a bare segment and after that one with a branchlet placed on the left side, then follows a segment with a branch also to the left; then again we have a bare segment, then one with a branchlet to the right, and then a segment with a branch on the same side. The arrangement of branches, branchlets and bare segments in these two last mentioned groups of segments agrees very much with that found in *H. secunda*, the only difference being that in the true *Herposiphonia secunda* we have two consecutive bare segments, whereas in the present case there is a single one only. After these groups followed three segments with branchlets and one with a branch placed in the ordinary way as found in *H. tenella*, and then again a group of segments deviating as to their branching from the type, like those already described. As pointed out above, it cannot be denied that this abnormal branching largely recalls that found in *H. secunda*, a modification which Falkenberg has also noted in this species (cfr. Falkenberg, l. c., p. 307, pl. 3, fig. 11). But as other parts of the plant were branched in accordance with the typical form I have no hesitation in referring my plant to *H. tenella.* Yet in another point this plant differs from the true *H. tenella*, recalling *H. secunda*, viz. in the very short segments, these being much shorter than their breadth, for instance in the branchlets: length = about 25 μ, breadth = about 35 μ.

Falkenberg discusses this question how far *Herposiphonia secunda* really is to be considered as an independent species or is nothing else than a form or variety of *H. tenella.* Leav-

ing at first the different ramification of the two plants out of consideration, he points out that according to the diagnosis of the two species the following two differences are the only found, namely: 1, the short segments of *Herposiphonia secunda* and 2, the lesser number of the segments and sporangia in the branchlets of *H. secunda.* As to the first mentioned difference he remarks that this is of no great importance, as he has found in all other respects a quite typical form of *tenella* having altogether the same habitus as that of *H. secunda**). And regarding the other point I need only refer to my remarks above concerning the small number of segments and of tetrasporangia developed in my specimens. But when FALKENBERG nevertheless regards the two plants as separate species, he bases this upon the most essential difference between them, viz.: the heterogeneous arrangement of branches and branchlets, pointing out that he has never found the ramification of *H. tenella* in typical specimens of *H. secunda.* But as to this point it cannot be denied that the above described specimens, actually having the ramification of both plants, greatly weakens the supposition that the two plants are to be regarded as two distinct species. Most probably, therefore, *H. secunda* is nothing more than a reduced form or variety of *H. tenella.*

Curiously enough the plant coming near to *secunda* was found intermingled with a quite normally branched var. *typica* of *Herposiphonia tenella* the contrast between the two forms being enhanced by the fact that it was provided with slender, long segments, much longer than those found in the form from St. Croix; for instance in one specimen the segments of the main stem were 100 μ broad and 280 μ long, and in the branchlets about 50 μ long and 30 μ broad.

FALKENBERG too states (l. c., p. 308) that he found "beide Arten in Neapel das ganze Jahr hindurch an den gleichen Standorten neben einander". This seems to show that the two plants in question are in all cases in reality more or less strongly differentiated forms, and are not developed by the influence of different external conditions.

*) In this connection I also want to refer to the form which ASKENASY in "Forschungsreise S. M. Gazelle". IV Theil, Botanik, p. 50, pl. X, figs. 14—17 has described and figured as *Polysiphonia Calothrix.* From this it seems to me beyond all doubt that the plant in question is our plant of which ASKENASY has found not only the typical *tenella* but also *secunda.* According to the figures both forms have short segments.

Both plants are found near the shore to a depth of a few feet only and in rather sheltered localities. Tetrasporangia were found in January.

St. Croix: Protestant Cay at Christiansted; St. Jan: Cruz Bay.

Geogr. Distrib.: Mediterranean Sea, Morocco, West Indies, Bermuda.

Fig. 290. *Dipterosiphonia dendritica* (Ag.) Falkenb.
Part of the thallus showing the ramification. (About 80:1).

Dipterosiphonia Schmitz et Falkenb.

1. **Dipterosiphonia dendritica** (Ag.) Falkenb.

Falkenberg, P., Die Rhodomelaceen, 1901. p. 324.
Hutchinsia dendritica Ag., Systema, p. 146; Species Alg., vol. II, p. 104.
Polysiphonia dendritica J. Agardh, Species Alg, vol. II, p. 3, pag. 916.

Of this beautiful, small plant a few specimens were found attached to *Cladophora fuliginosa*. Referring for further details to the

above quoted description of FALKENBERG, I shall here only mention briefly the specimens found (Fig. 290).

What mostly characterizes this genus is the dorsiventrally built, creeping main filaments, from which the exogenous branches are formed alternately in pairs on both sides; of these branches the lower one becomes a short, unbranched branchlet, while the other, the upper, becomes ramified in a similar way as the mother filament.

Dipterosiphonia dendritica has 5 pericentral cells which are mostly arranged in rather distinct rows. Of these 5 cells in each segment, the two are placed on the somewhat flattened, lower,

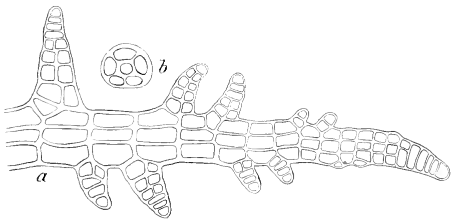


Fig. 291. *Dipterosiphonia dendritica* (Ag.) Falkenb.
a, summit of a filament seen from above. *b*, transverse section of the thallus. (About 180 : 1).

ventral side, while the three others are found on the upper dorsal side (Fig. 291 *b*).

The main stem is about 115 μ thick. From the ventral cells vigorous short rhizoids issue; these end in irregularly lobed discs by means of which the plant is fixed to the host plant (see Fig. 290).

Of the branches placed in pairs the one is, as mentioned above, developed like the main stem. It is ramified in the same way but is generally less vigorous. Its branches are commonly unbranched and it stops in most cases its longitudinal growth after having developed 5—6 pairs of branches: but occasionally under favourable conditions the branches grow out to real main stems like the mother filament (Compare Fig. 290).

The short branchlets remain undivided. Sometimes they are short or quite rudimentary, sometimes they grow to a considerable length. They are about 60 μ thick. A few trichoblasts were found upon the short branchlets.

By reason of the greatly varying development of the branches and branchlets their original arrangement in pairs is often much

effaced in older parts of the thallus. In the young parts, on the other hand, it is always very distinct (comp. Fig. 291 *a*).

Upon the specimens found only two tetrasporic stichidia were present. The tetrasporangia are formed in the ends of the ramuli. The fertile part consists of 3—4 segments. It is so much swollen that, as pointed out by FALKENBERG, l. c., "die sterile Stammbasis dagegen als dünner Stiel scharf abgesetzt erscheint". The fertile part is about 80 μ thick.

With regard to the figures hitherto given intended to portray this species, they are all more or less unhappy. I refer to FALKENBERG's statement concerning this matter.

Dipterosiphonia dendritica was found growing on a rather exposed place and in shallow water. Besides upon *Cladophora fuliginosa* some other specimens have been found upon *Laurencia papillosa*.

St. Croix.: White Bay.

Geogr. Distrib.: Brazil, Australia.

Subfam. 5. Lophosiphonieæ.

Lophosiphonia Falkenb.

1. **Lophosiphonia obscura** (Ag.) Falkenberg.

FALKENBERG, P., Rhodomelaceen, p. 500.

Hutchinsia obscura Ag., Spec. Alg., p. 108.

Polysiphonia obscura J. Ag., Algæ Mediterr., p. 123; Spec. Alg., vol. II, pars III, p. 943.

In the few specimens I have collected the number of the dericentral cells was about 11—12. There was no cortical layer present.

The plant forms low tufts about 1—3 cm high. The basal creeping filaments are fastened to the substratum by means of numerous short hapters (Fig. 292 *a*), a single one emerging from each pericentral cell, but often 2—3 side by side from each segment (Fig. 292 *b*). The hapters end in irregularly lobed discs.

The diameter of the creeping filaments is about 150 μ long. From the upper side of the creeping filaments branches emerge, arranged more or less dorsally, the distance between them varying much. Some of these branches bend downwards and fix themselves to the substratum like the mother filament, but the greater part grow upwards.

While the creeping filaments lack trichoblasts, these are present in the summit of the erect filaments (Fig. 293). In some specimens taken from exposed places these were abundantly developed, in others taken from sheltered spots they were very scarce, often quite wanting.

The trichoblasts are developed in the upper end of the branches, and, when they first appear, each segment often bears one. As pointed out by FALKENBERG they are placed with a divergency

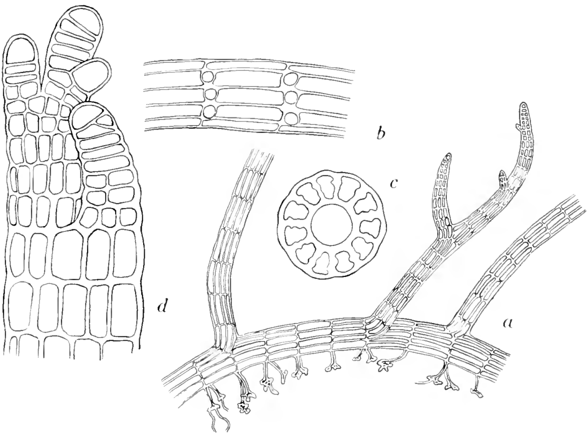


Fig. 292. *Lophosiphonia obscura* (Ag.) Falkenb. *a*, basal part of plant; *b*, part of a basal filament showing scars after rhizoids placed in rows. *c*, transverse section of the thallus. *d*, summit of a filament. (*a*, about 30:1; *c*, about 200:1; *b* and *d*, about 450:1.)

of about $^1/_4$. The trichoblasts are rather robust with somewhat thick walls; near the base of the trichoblasts the cells are about 28 μ thick and the walls of the cells about 4 μ. Most probably the trichoblasts serve as a protection for the young tips, not only against the strong light, but also against the violence of the waves.

The erect filaments are more or less branched; the branches have no connection with the trichoblasts (Fig. 293). The uppermost young summits of the branches are much curved, turning their concave side towards the mother branch.

The tetrasporangia (Fig. 294) are found in shorter or longer

series, a single one in each segments; they are mostly placed rather clearly in screws. The tetrasporangia are about $60\,\mu$ broad.

The plant grows in shallow water near the shore and has been found both in sheltered as well as in more exposed localities.

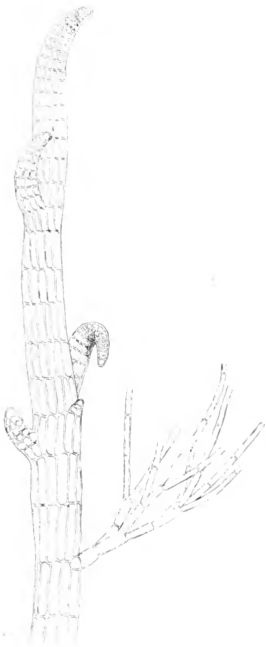


Fig. 293. *Lophosiphonia obscura* (Ag.) Falkenb. Upper end of a filament. (About 100:1).

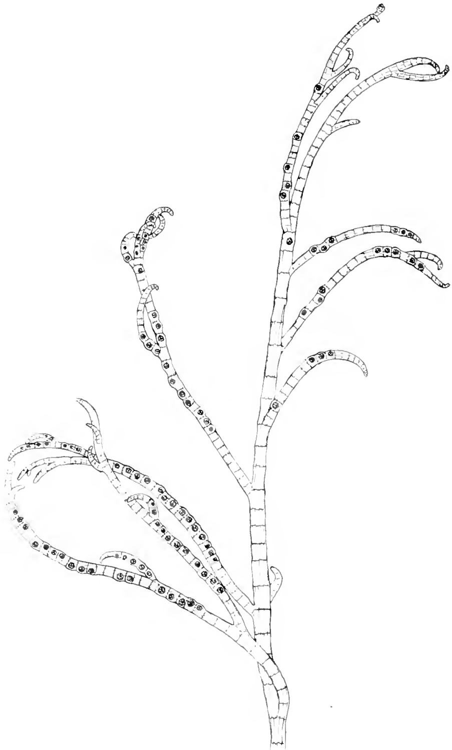


Fig. 294. *Lophosiphonia obscura* (Ag.) Falkenberg. Part of a plant with tetraspores. (About 20:1.)

St. Croix: Christiansted's Lagoon, White Bay. The plant has been collected earlier by Ørsted on the shores of this island.

Geogr. Distrib.: West Indies, Mediterranean Sea and warmer parts of the Atlantic Ocean.

2. **Lophosiphonia cristata** Falkenb.

Falkenberg, P., Die Rhodomelaceen, p. 499.

The West Indian plant (Fig. 295) seems to agree very well with the plant from Naples, to judge by the description and figures of Falkenberg. However, regarding the number of the pericentral cells a difference is noticeable, as Falkenberg has found 6—8 pericentral cells in his plant, while mine has 9—10, now and then in the erect branchlets even more (Fig. 296).

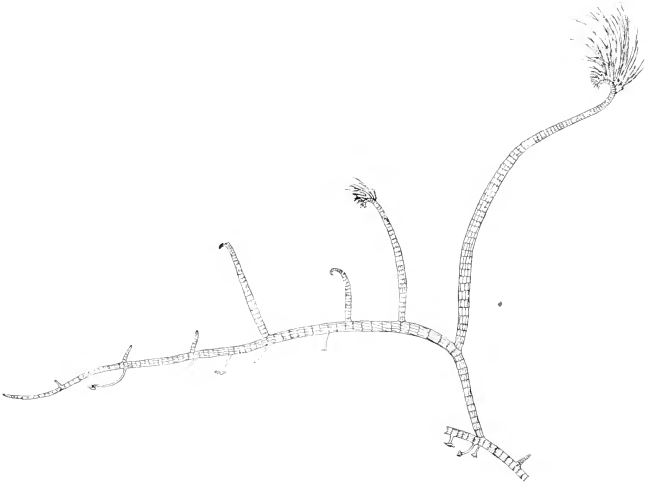


Fig. 295. *Lophosiphonia cristata* Falkenb. Part of a plant. (About 20:1).

In accordance with the description of Falkenberg our plant has a creeping rhizome-like stem with indefinite growth, from the dorsal side of which issue endogenous erect branchlets. The distance between these branchlets varies somewhat in the different specimens, but each specimen has generally about the same number of segments between the branchlets; for instance one specimen had only about 4—5 naked segments between those bearing branchlets, another specimen had 10—12 segments. Trichoblasts are entirely absent upon the creeping stem. This grows by means of a large apical cell (Fig. 297) from which thin segments are cut off. The peri-

central cells are at first formed on the upper, dorsal side of the rhizome, somewhat later on the lower, ventral side and the growth is upon the whole to begin with most vigorous on the upper side. By this habit of growth the summit of the rhizome is turned downwards towards the substratum (Fig. 297), later on by augmented growth on the lower side this curve is again eliminated.

From the pericentral cells of the ventral side of the rhizome hapters grow out, fixing the plant to the ground or to other algæ (Fig. 295). The rhizoids are in open connection with the mother cell; they have very thick walls, their lumen being reduced to a narrow channel; they end in an irregularly lobed disc. The rhizomes are about 80—120 μ thick and the segments about as long as broad or somewhat shorter, about 80 μ long.

Fig. 296. *Lophosiphonia cristata* Falkenberg. Transverse section of the thallus. (About 150:1).

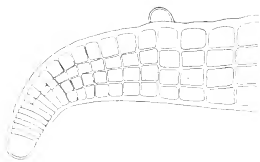


Fig. 297. *Lophosiphonia cristata* Falkenberg. Summit of creeping filament. (About 265:1).

The erect branchlets are to begin with not curved in their upper end and are destitute of trichoblasts (comp. Fig. 295). But soon the summit becomes curved or even somewhat involute. The hook-formed summit it always turned forwards towards the growth-point of the rhizome.

When the branchlets have reached a certain length, which varies somewhat in the different branchlets, they begin to develop trichoblasts from the convex side (Fig. 298). The trichoblasts are placed in a single row, at first at some distance from each other, but later on nearer and nearer until at last nearly every segment has a trichoblast.

The development of the trichoblasts begins very early and proceeds so vigorously that they are rather large even before the segment which bears a trichoblast is divided (Fig. 298).

The branchlets have at their base nearly the same number of pericentral cells as the rhizome, but higher up, as already mentioned, a larger number. I have counted 10—12. At the same time as the number of the cells increases the cells grow shorter;

thus in one branchlet the cells had at its base a length of about 70μ, while higher up in the branchlets they had only half this length, about 35μ.

By and by as the branchlets grow longer they at the same time become straight, the cells being lengthened in the concave side in proportion to those of the convex side; by this way of growing the uppermost summit of the branchlet only is constantly hook-formed.

The trichoblasts are unilaterally developed and when young they curve in the same direction as the summit of the branchlet (Fig. 298).

Later on they are straightened and assume the common appearance of the trichoblasts. They are vigorously developed and 4—5 times pseudo-dichotomously divided. Nevertheless they are generally shed early, leaving back clearly observable scars.

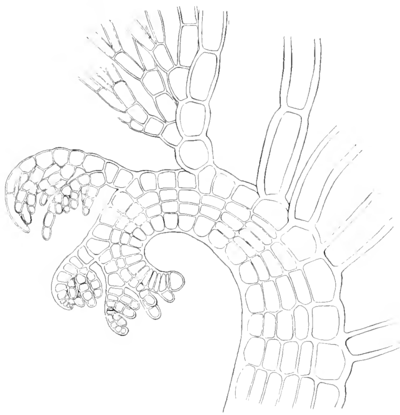


Fig. 298. *Lophosiphonia cristata* Falkenb. Summit of branchlet. (About 180:1).

It has been mentioned above that the trichoblasts are seriated, but, as pointed out by Falkenberg, a trichoblast is occasionally placed somewhat out of the series. This is according to Falkenberg still more the case in the tetrasporic plant, but having had only sterile plants at my disposal, I refer as to this matter to the description of Falkenberg.

The plant was found in a rather exposed locality, growing between and sheltered by some larger algæ. These algæ, especially *Caulerpa racemosa* f. *reducta*, *Cladophoropsis membranacea*, *Valonia utricularis*, *Jania* etc. formed upon the reef a dense carpet in which smaller algæ, e. g. *Polysiphonia ferulacea* and the present one were creeping.

On the shores of the islands it has only been found once, at St. Thomas: Near Charlotte Amalia on the reef connecting the Hurricane Island with St. Thomas.

Geogr. Distrib.: Hitherto only found once in the Mediterranean Sea at Naples.

Subfam. 6. Bostrychieæ.

Bostrychia Montagne.

1. Bostrychia tenella (Vahl) J. Ag.

Agardh, J., Spec. Alg., vol. II, p. III, p. 869. Analecta Algologica, cont. IV, 1897, p. 83. Falkenberg, P., Rhodomelaceen, p. 515.

Fucus tenellus Vahl, Endeel kryptogamiske Planter fra St. Croix (Skrivter af Naturh. Selskab, 5te Bd., 2 Hefte, Kiøbenhavn 1802, p. 45).

For more synonyms compare: De-Toni Sylloge Alg., Vol. IV, p. 1162.

Bostrychia tenella (Fig. 299) occurs as a rather common epiphyte upon the roots of the mangroves, or it grows upon stones

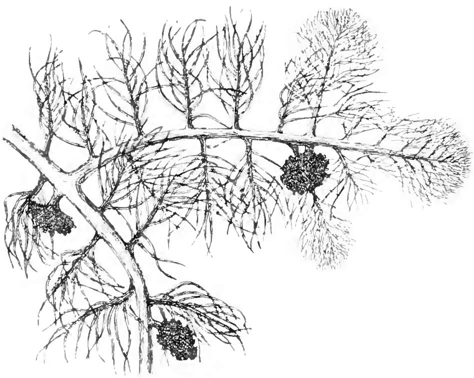


Fig. 299. *Bostrychia tenella* (Vahl) J. Ag. Part of a plant. (About 8:1.)

and rocks near or in shaded localities somewhat above the surface of the sea.

It has 6 to 8 pericentral cells, 8 in the older main stems, fewer upwards in the branches; in the branchlets the number of pericentral cells decreases more and more, making an even transition to the often long monosiphonous summits of these.

The pericentral cells are in an early stage of development divided by horizontal walls into two cells. From the outer sides of these cells, as described by Falkenberg, cells are cut off from which the cortical layer originates. This makes a thick cover upon the main stem (Fig. 300), thinner upon the side-branches, and disappears gradually upwards, the thinner branchlets being quite uncovered.

The main filaments increase by means of a large apical cell from which flat segments are cut off (Fig. 301), Alternately, from each of these, branches issue forming two opposite rows.

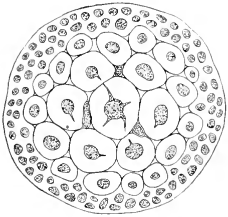


Fig. 300. *Bostrychia tenella* (Vahl) J. Ag. Transverse section of the thallus. (About 150:1).

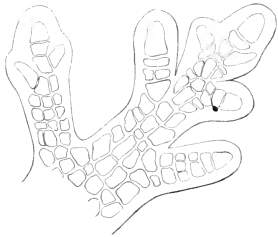


Fig. 301. *Bostrychia tenella* (Vahl) J. Ag. Top of a filament. (About 200:1).

My specimens belong to the typical form, having the side-branches arranged distichously.

Bostrychia tenella is fastened to the substratum by means of vigorous rhizoids growing out anywhere from the filaments (Fig. 299). As described by Falkenberg these haptera consist of congenital outgrowths from a group of surface cells, these at first forming together a vigorous stem, later becoming more or less separated or broadened out to a small disc (Fig. 302).

Upon a transverse section of the main stem it is seen that the central and pericentral cells have very thick and stratified walls (Fig. 300).

Plants with tetraspores and cystocarps are found.

The stichidia are formed in the ends of the ramuli and have mostly four, sometimes fewer, verticillated sporangia in each segment. I have not observed any tendency to uniseriated stichidia. The sporangia are tetrahedrically divided.

Fig. 302. *Bostrychia tenella* (Vahl) J. Ag. End of a young hapter. (About 125:1).

The cystocarps (Fig. 303) are placed in the summits of the side-branches. Their shape is spherical-urceolate.

Bostrychia tenella was originally described by Vahl from specimens from St. Croix.

It occurs both in sheltered and in more exposed places, and where it is constantly moistened by the spray it is able to grow somewhat above the surface of the sea, especially when found

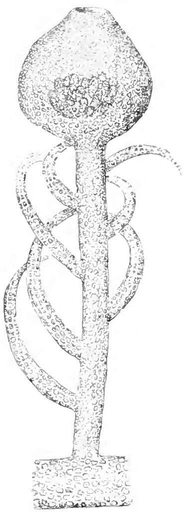


Fig. 303. *Bostrychia tenella* (Vahl) J. Ag. Summit of branch with cystocarp. (About 25:1).

in its favourite growing places: dark ravines etc. It has been found with tetraspores and cystocarps in the month of January.

St. Croix: The harbour of Christiansted and the lagoon at the same town; Salt River Lagoon. St. Tomas: St. Nordsidebugt. St. Jan: Cruz Bay.

Geogr. Distrib.: Widely distributed in all warmer seas.

Subfam. 7. Lophothalieæ.

Lophocladia Schmitz.

1. Lophocladia trichoclados (Mert., C. Ag.) Schmitz.

Fr. Schmitz, Die Gattung Lophothalia (Ber. d. deutsch. bot. Ges., Bd. XI, 1893, p. 222). Falkenberg, P., Rhodomelaceen, p. 553.

Conferva trichoclados Mert. mscr.

Griffithsia trichoclados Ag., Spec. Alg., II, 1828, p. 132.

Dasya lophoclados Mont. in Ann. Sc Nat., Bot., II. sér., 1842, p. 254; Harvey, Nereis Bor.-Am., II, p. 65.

Polysiphonia lophoclados Kütz., Spec. Alg., p. 834; Tabulæ Phycol. XIV, tab. 22, fig. a—b.

Dasya trichoclados J. Ag., In Historiam Algarum Symbolæ, Linnæa, vol. 15, 1841, p. 32; Spec. Alg., vol. II, p. 3, p. 1229.

Lophothalia (Lophocladia) trichoclados J. Ag., Till. Algernes Systematik, XI, Florideæ, p. 64.

The figure (Fig. 304) shows the summit of a filament. From the large apical cell disc-formed segments are cut off. From these the trichoblasts soon grow out, before they are yet divided, the segments being divided rather late into a central and four pericentral cells. Also in the trichoblasts transverse walls are developed rather late.

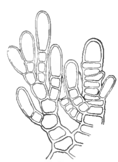


Fig. 304. *Lophocladia trichoclados* (Mert., C. Ag.) Schmitz. Summit of a filament. (About 260:1).

The trichoblasts are placed in a screw turning to the left with a divergency of 1/4, one from each segment (Fig. 305). They are monosiphonous throughout their whole length and several times branched. As is usually the case the ramification in the full grown trichoblast seems to be dichotomous but when young stades are examined we see that it is monopodial with alternate

branching (Fig. 306). In the fully developed trichoblast all the branches are arranged fan-like in one plane, the trichoblast turning its flat side against the main filament (Fig. 305). The basal cell of the trichoblasts bears no side-branch, is very short and more or less sunk between the pericentral cells; then follows a short cell bearing the first side-branch. This is always found at the right, anodic, side of the trichoblast. It begins with a short, basal cell. In the next branch the basal cell is still short, though somewhat longer. The first side-branch of the trichoblast is that which is transformed into the stichidium (comp. Figs. 306 and 307).

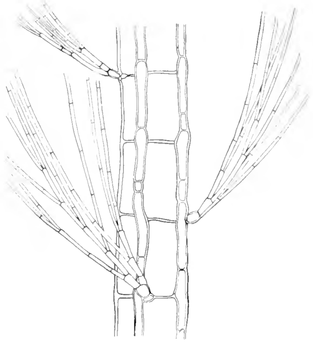


Fig. 305. *Lophocladia trichoclados* (Mert., C. Ag.) Schmitz. Part of a filament with trichoblasts. (About 45:1).

In the fully developed trichoblasts the cells are long and cylindrical, about 23 μ thick and 250 μ long, somewhat shorter and thicker towards the bottom, longer and thinner towards the top.

Exogenous branches formed in the summit of the plant seem to be entirely wanting. I have looked for them in vain, and FALKENBERG did not find them either. The ramification of the plant takes place by means of endogenous, adventitious branches, formed later. The segments in the main filaments are about 175 μ broad, being scarcely double this length, about 270 μ long.

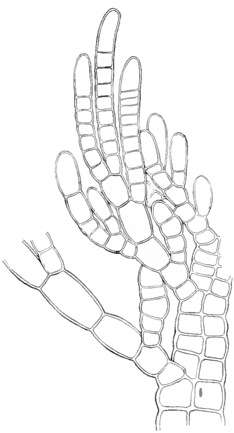


Fig. 306. *Lophocladia trichoclados* (Mert., C. Ag.) Schmitz. Young trichoblasts near the summit of a filament, showing development of stichidia. The uppermost one is still undivided, the following consists of four cells, the lowermost of five. (About 260:1).

In the upper young parts of the filaments no cortical layer is present; the older parts of the filaments on the other hand are more or less covered by cortex. The first beginning of the cortical layer is formed by rhizoids growing

out from the basal end of the pericentral cells (comp. Fig. 307) and running down in the furrow between these cells (Fig. 305).

Most of my specimens were richly provided with stichidia (Fig. 307). As the figure 306 shows, these originate from the first side branch of the trichoblast which issues from the second joint in these. One or two segments in the basal part of the stichidia remain undivided. All the following segments become polysiphonous with the exception of some of the uppermost ones, which are small, sterile and not divided. As described by SCHMITZ (l. c., p. 233) the stichidia are unbranched, but this is only apparently so, according to Falkenberg's observations. For, as pointed out by this author, a small cell is cut off from each segment by an oblique wall, these small cells placed with a divergency of $^1/_4$ round the stichidia, being the first beginning of branching. Normally these cells are not further developed, and I have not succeeded in finding any stichidia with branches, but FALKENBERG happened to find one in which the cells in the monosiphonous branches reached the number of 13. The first pericentral cell in the segment is formed under this small cell, and becomes therefore shorter than the others, of which one is fertile. A single tetrasporangium is shaped in each segment; they are placed in screw line and the stichidia upon the whole are beautifully screw-formed (Fig. 307). The tetrasporangia are tetrahedrically divided.

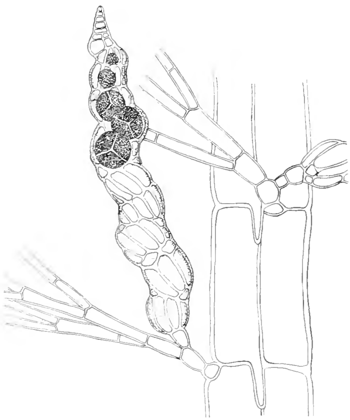


Fig. 307. *Lophocladia trichoclados* (Mert., C. Ag.) Schmitz. Part of a filament with the lower parts of two trichoblasts and a stichidium. Some of the tetrasporangia have fallen out. The downwards directed outgrowths from the two pericentral cells are the beginning cortical layer. (About 80:1).

As far as I know the tetrasporangia are up to this date the only known organs of fructification of this plant. The discovering of a small piece of a male plant and of a female one, was therefore of much interest. Neither the antheridia nor the cystocarps show any more essential peculiarities: both kinds of fructiferous organs are very like those, e. g. found in *Polysiphonia*.

As, in the case of the stichidia, the antheridial stands (Fig. 308) are found in the trichoblasts and originate from the first side-branch of these. But while the whole side-branch is employed in the development of the stichidium, this normally having no branchlets, this side-branch in the male plant has one to three branchlets besides the terminally placed antheridial stand. The antheridial stands are cylindrical to spindle-shaped, with an obtuse apex. At their base they have a stalk composed mostly of three short cells and, at their summit, two small sterile cells.

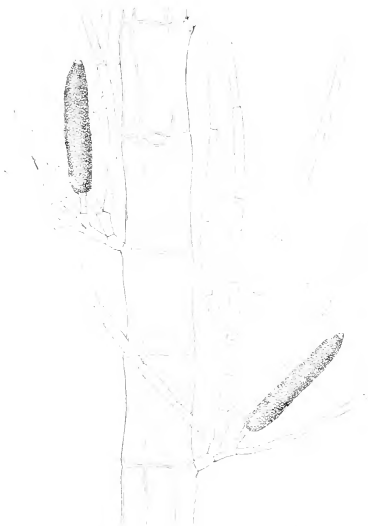


Fig. 308. *Lophocladia trichoclados* (Mert., C. Ag.). Schmitz. Part of a filament with trichoblasts, two of which bearing antheridial stands. (About 100 : 1).

The development of the antheridial stands takes place in the following manner: the branch at first is divided by transverse walls in a number of short cells above each other (Fig. 309 *a*) whereupon these again are divided: firstly by longitudinal walls (Fig. 309 *b*), later by walls in various directions into a great number of small roundish-polygonal cells at the pheriphery. From these the antheridia are formed.

The procarps originate from the second segment of the trichoblast (Fig. 310). This becomes polysiphonous, consisting of the central cell and the five pericentral ones as always in the case of

the *Rhodomelaceæ* even if the vegetative segments have another number. The basal segment of the trichoblast does not become polysipho-

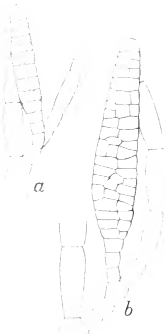


Fig. 309. *Lophocladia trichoclados* (Mert., C. Ag.) Schmitz. Two young antheridial stands in various stages of development. (About 265:1).

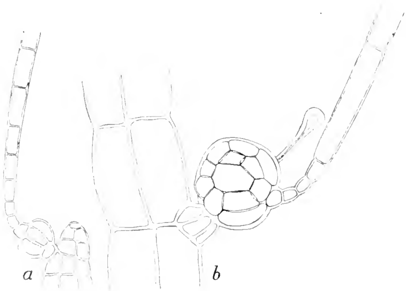


Fig. 310. *Lophocladia trichoclados* (Mert., C. Ag.) Schmitz. The basal part of two trichoblasts with procarps. (About 265:1).

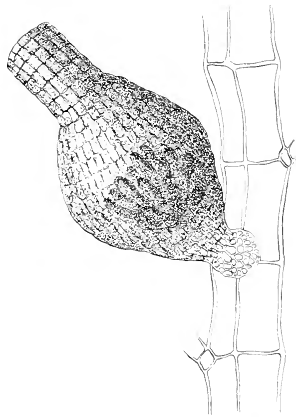


Fig. 311. *Lophocladia trichoclados* (Mert., C. Ag.) Schmitz. A ripe cystocarp. (About 60:1).

nous until the procarp is more developed (cfr. Fig. 310). The upper sterile part of the trichoblast remains monosiphonous and undivided.

The figure 310 shows the only two stages of development found, but to judge from these the cystocarps are developed in the usual way found in the *Rhodomelaceæ*. One of the pericentral cells is divided by a longitudinal wall into two cells: one of these being the auxiliary mother cell, the other one producing the carpogonial branch. The trichogyne is rather

short, clavate and of the same shape as the one often found in the *Rhodomelaceæ*.

I have not been able to follow the further development. The mature cystocarp (cp. Fig. 311, the only one found) is lageniform having a rather long neck and a roundish basal part.

Lophocladia is fixed to the substratum (stones, shells etc. or other algæ) by means of vigorous rhizoids breaking out from the decumbent parts of the filaments (Fig. 312). These rhizoids are monosiphonous or plurisiphonous. They end in a disc. From the creeping

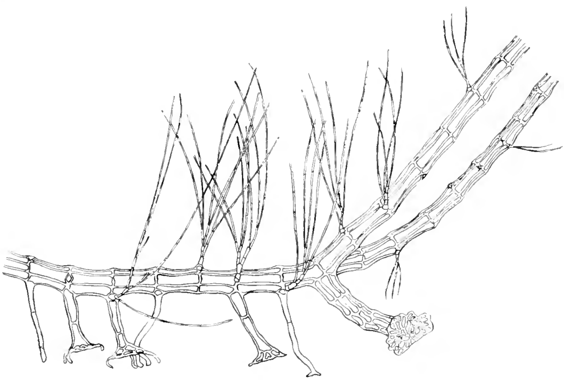


Fig. 312. *Lophocladia trichoclados* (Mert., C.Ag.) Schmitz. Basal, decumbent part of filaments with rhizoids and larger haptera. (About 80:1).

decumbent parts of the filaments the free upper ends bend upwards (comp. Fig. 312) or new erect branches are produced.

Regarding the hyphæ-like rhizoids, mentioned above, which form the cortical layer, we find that these at their outgrowth are separated from the mother pericentral cell by a wall. By a mistake this wall has been omitted in Fig. 307.

This plant has apparently given Falkenberg much trouble with regard to the trichoblast and the occurrence of the stichidium upon it. While Falkenberg begins his description of this plant by calling the trichoblasts "Kurztrieben" (l. c., p. 553) he ends by saying: "Meiner Ansicht nach liegt die Sache nun so, dass wir bei *Lophocladia trichoclados* echte Blätter haben". And, as to the formation of the

stichidium in the trichoblast, he thinks we have to do with an axillary branch. As his interpretation seems to me somewhat difficult to understand and — furthermore, as my observations do not always agree with his, I shall here enter a little more into this question.

Schmitz, the founder of the genus *Lophocladia*, considered the stichidium to be a transformed part of the trichoblast or "Haarblatt" as he calls it. Falkenberg, on the other hand, objects to this explanation. The fact that the distichously ramified and monosiphonous trichoblast in the stichidial part becomes plurisiphonous and spirally ramified leads him to the following conclusion: "Ich bin geneigt in dem Stichidium, gerade so wie bei *Lophothalia* und *Doxodasya*, einen durch sein Fertilwerden wenig modificierten Langspross zu erblicken, der an der Basis des Kurztriebs gewissermaassen als Achselspross aufgetreten ist". As my figure (Fig. 307) shows, the stichidia are never placed at the base of the trichoblasts, but upon the second basal cell of these, and how the stichidia in this case can be explained as axillary branches is difficult to understand.

In the following Falkenberg tries to particularize his interpretation; but as I differ from his opinion on several points I think I had better quote the paragraph in extenso.

Falkenberg says: "Und gewichtige Gründe lassen sich für diese Annahme anführen, wenn es mir auch nicht gelungen ist, durch Beobachtung der Entwicklung den direkten Beweis dafür zu erbringen; bei der ausserordentlichen Kleinheit und der dichtgedrängten Stellung der Kurztriebe am Vegetationspunkt habe ich nicht nachweisen können, ob die Stichidien, wie das ja nöthig wäre, thatsächlich als eine secundäre Bildung nachträglich am Kurztrieb sichtbar werden. Aber die Stichidien treten an solchen Segmenten der monosiphonen Kurztriebe auf, die — wenn letztere steril bleiben — überhaupt keine seitlichen Glieder produciren. Daraus geht eigentlich schon hervor, dass das Stichidium nicht aus der Metamorphose eines auch am sterilen Kurztrieb vorhandenen Seitengliedes entstanden ist — sondern dass es als ein Novum, und zwar nur an den fertilen Kurztrieben auftritt."

Regarding the first sentence I need only refer to my figure (Fig. 306) showing the development of the stichidia. In the most obvious manner it reveals the stichidium as the first side-branch upon the main filament of the ramulus. Falkenberg's supposition

that the stichidium should be "sichtbar nachträglich am Kurztrieb" does not agree with my observations.

Nor is his next sentence corroborated upon examination of the plant. FALKENBERG maintains here that the stichidia originate from segments of the trichoblasts which, when the trichoblasts are sterile, are never provided with branches. As is seen from figs. 305 and 307 a side-branch is always developed from the second segment in the sterile trichoblast, that is to say, just in the same place as that occupied by the stichidium in the fertile. According to my view and in contradiction to that of FALKENBERG, we arrive at the following conclusion: that the stichidium has come into existence just through the metamorphosis of the first side-branch issued from the trichoblast and, it cannot therefore be considered as a "novum" found only upon the fertile trichoblast.

And the occurrence of the antheridial stands just in the same side-branch of the trichoblast as the stichidia (a part of this side-branch being polysiphonous and transformed in the antheridial stand just as in the case of e. g. *Polysiphonia*), seems to me still more to corroborate the correctness of my view.

As to the rest of FALKENBERG's reflections concerning this subject I am not going to discuss them here. For we have solved the difficulties when we look upon the ramulus as a trichoblast (= Haartrieb OLTMANNS). Concerning the trichoblast and its relation to the stem I just want to refer to ROSENVINGE's instructive paper: "Sur les organes piliforme des Rhodomelacées"*) and especially tò chapter 5: Formes intermédiaires entre tiges et trichoblastes" and to OLTMANNS remarks in Morphologie und Biologie der Algen, Bd. 1, 1904, p. 609 and especially p. 709.

Besides some specimens washed ashore I have only dredged this plant in deep water at about 10—15 fathoms in rather open sea and in places where strong currents prevailed. It was found with tetrasporangia in the months January—March and with antheridia and cystocarps in the month of March.

As in the case of so many West Indian algæ this one, too, seems originally to have been described from specimens gathered at the

*) In Oversigt over det kgl. danske Videnskabernes Selskabs Forhandlinger, 1903, No. 4.

Danish islands: comp. J. AGARDH, Spec. Alg., vol. II, p. III, p. 1230. Later on ØRSTED collected it at St. Thomas and St. Croix.

St. Croix: Near Green Cay Estate and at the entrance to the lagoon of Christiansted (both places washed ashore). St. Jan: Dredged in many places in the sound between this island and St. Thomas.

Geogr. Distrib.: West Indies.

Wrightiella Schmitz.

1. **Wrightiella Tumanowiczii** (Gatty) Schmitz.

SCHMITZ, FR., Die Gattung Lophothalia J. Ag. (Ber. der deutsch. bot. Ges., Bd. XI, 1893, p. 222. FALKENBERG, P., Rhodomelaceen, p. 559.

Dasya Tumanowiczii Gatty in HARVEY, Nereis Bor.-Am., part II, p. 64. KÜTZING, Tabul. Phycol., vol. XIV, tab. 63.

The plant has four pericentral cells which on a later stage are more or less covered by a cortical layer (Fig. 314).

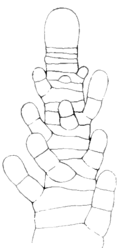


Fig. 313. *Wrightiella Tumanowiczii* (Gatty) Schmitz. Summit of the thallus. (About 500:1).

What especially distinguishes this plant are the polysiphonous, short, spinelike endogenous branchlets found scattered upon the thallus. Moreover it is endowed with exogenous, mostly short living, monosiphonous side-organs. These FALKENBERG refers to as "monosiphone Kurztriebe (nicht Blätter)", I call them trichoblasts.

The plant increases by means of an apical cell from which flat segments are cut off (Fig. 313); from these the trichoblasts begin to grow out long before the segments are divided.

The trichoblasts are placed in a screw line, with a divergency of $^1/_4$ of the periphery, upon the main filament (Fig. 314) and consist of a monosiphonous main stem, from which the monosiphonous branches issue spirally with a divergency of $^1/_3$—$^1/_4$. In the sterile plant the cells in the trichoblasts are small at the base, increasing evenly until somewhat above the middle of the whole trichoblast, then tapering slowly to the blunt or generally acute ends of the filaments (Fig. 315). The cells of the trichoblast are cylindrical or barrelshaped with thin walls.

In the trichoblast both the tetrasporangia and the cystocarps are developed. When we have to do with the last mentioned organs, which I have not found in my specimens, the trichoblasts, according to FALKENBERG, are more persistent and the lowest segments be-

come polysiphonous (cfr. Falkenberg, pl. 13, fig. 14). In the tetrasporic plant, on the other hand, the upper end of the main stem in the trichoblast becomes polysiphonous and transformed into stichidia, while the lowest part remains monosiphonous (Fig. 317 a).

The polysiphonous side-organs are developed quite independently of the trichoblasts. As pointed out by Falkenberg they are of later origin than the trichoblast, first appearing after the division of the segments in the main filament and must be considered as adventitious branches. Falkenberg found them rather regularly distributed, generally placed with 1/4 divergency a single one upon each segment. In my plants the arrangement was not so regular, as segments without branches often occurred. As indicated by Falkenberg the central axis of these reaches into the central cell in the main filament (Fig. 316); this, I think, largely supports the supposition that they really are of endogenous origin. The greatest part of these branches remains short, and spinelike; now and then a single one gets a continuous growth like the main filament and contributes to the ramification of the plant. The spinelike branchlets are of a rather soft consistence; they are always undivided and consist of up to ten segments with four pericentral cells, the segments getting smaller and smaller towards the top. In the uppermost segment only a single cell is present.

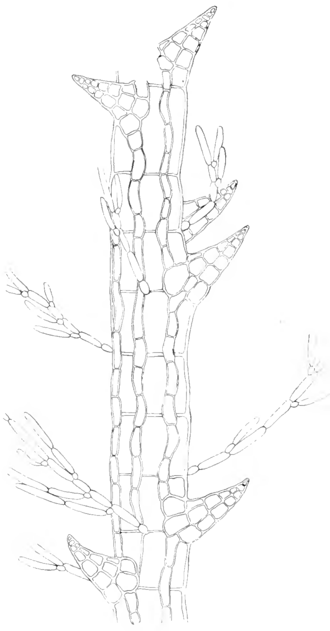


Fig. 314. *Wrightiella Tumanowiczii* (Gatty) Schmitz. Part of a main axis with trichoblasts and spinelike branchlets. From the basal cells of these hyphæ are seen growing downwards forming the cortical layer. (About 60:1).

From the basal pericentral cell of these branchlets hyphæ-like

filaments grow downwards in the furrow between the pericentral cells of the main filament (Fig. 314); later on from the other basal pericentral cells in the branchlets similar filaments are issued, forming together the cortical layer surrounding the central axis in the main filament.

As already mentioned the stichidia (Fig. 317) are formed in the upper end of the trichoblasts. The upper end of the central axis becomes polysiphonous and a sporangium is developed in each segment. The sporangia are arranged in a spiral line and, as they increase in size proportionately much more than the sterile cells of the

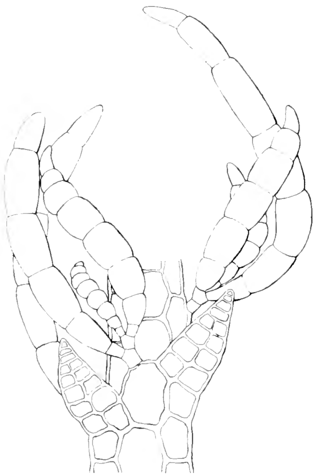


Fig. 315. *Wrightiella Tumanowiczii* (Gatty) Schmitz. Part of young filament with trichoblast and spinelike branchlets. (About 90:1).

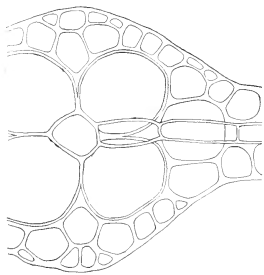


Fig. 316. *Whrightiella Tumanowiczii* (Gatty) Schmitz. Tranverse section of a main stem from the place where a spinelike branchlet is issued. (About 50:1).

segments, the whole stichidium becomes screwformed. As in the case of the sterile part so also in the fertile one each segment carries a monosiphonous ramulus. In the fertile part these are often rather short. A short, sterile tip with small ramuli arranged spirally crowns the stichidia.

The fig. 317 shows a comparatively short stichidium and a longer one: these contain often twenty or even more sporangia. The basal monosiphonous part of the trichoblasts is in all essentials like that of the sterile trichoblasts; but the cells are slender and, on the other

hand, longer, nearly cylindrical of shape: it is generally rather long, I have counted 22 joints in the main axis.

In their outward appearance the specimens found do not to any great extent resemble either *Wrightiella Blodgettii* or *W. Tumanowiczii*. They are very irregularly ramified, and the trichoblasts are very perishable and only to be found in the uppermost ends of the branches. The spinelike branchlets are short and scarcely visible. On account of this fact I have referred my plants to *Wrightiella Tumanowiczii*. But, as pointed out by SCHMITZ (l. c., p. 222) who examined original specimens of both species, they are very nearly related and FALKENBERG even points out that most probably the two plants are nothing else but different forms of the same species. The fact that my plant differs in appearance from the others may perhaps be due to its occurrence in deep water, suggesting at the same time that most probably the plant is rather a plastic one.

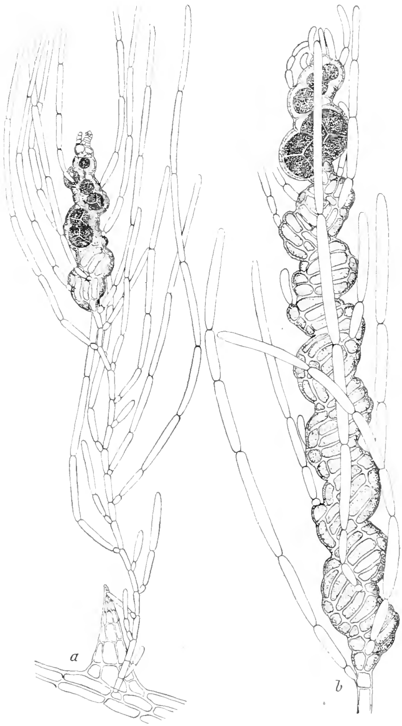


Fig. 317. *Wrightiella Tumanowiczii* (Gatty) Schmitz. *a*, part of main stem with spinelike branchlet and a trichoblast with stichidium. *b*, a stichidium. (*a*, about 60:1; *b*, about 100:1).

This plant was dredged in about 10—15 fathoms of water in rather open sea. It had tetrasporangia in the month of March.

St. Jan: Off Cruz Bay in the sound between this island and St. Thomas.

Geogr. Distrib.: Florida (Key West), Bermuda.

Murrayella Schmitz.

1. Murrayella periclados (Ag.) Schmitz.

SCHMITZ, FR., Die Gattung Lophothalia J. Ag. in Berichte d. deutsch. bot. Ges., Bd. XI, 1893, p. 227. FALKENBERG, P., Rhodomelaceen, p. 563, pl. 12, figs. 24—25.

Hutchinsia periclados Ag., Spec. Alg., vol. II, p. 101.

Polysiphonia periclados Kütz., Species Alg., p. 822.

Bostrychia Tuomeyi Harv., Nereis Bor. Am., Part II, p. 58, pl. XIV E.

Bostrychia periclados J. Ag., Spec. Alg., vol. II, pars III, p. 861.

Polysiphonia Binderi Sonder in Kützing, Tab. Phycologicæ, vol. XIV, pl. 45 a, b.

Murrayella periclados is a common mangrove alga forming upon the roots of the mangroves dark red-brown, densely felted cushions. These consist of basal creeping filaments from which the erect ones grow up (Fig 318).

The creeping filaments can be more or less destitute of branches, but in most cases these are to be found even if they often are rather scarce and for the most part not much developed. The creeping filaments are fastened to the substratum by means of rhizoids (Figs. 318 and 319).

The rhizoids grow out near the ends of the pericentral cells. They issue singly or often several together from the same segment (Fig. 319). In this case the rhizoids are mostly grown together at their base, forming a bundle. Higher up the rhizoids become gradually free, spreading in all directions. These rhizoids remind one much of those found in *Bostrychia*. The rhizoids are often branched: they have cross walls and rather long cylindrical cells, about 3—5 times as long as broad; they are rather thick-walled, with stratified walls, often penetrating a little into the bark of the mangrove, the cells of which frequently are attached to the rhizoids after preparation (Fig. 318).

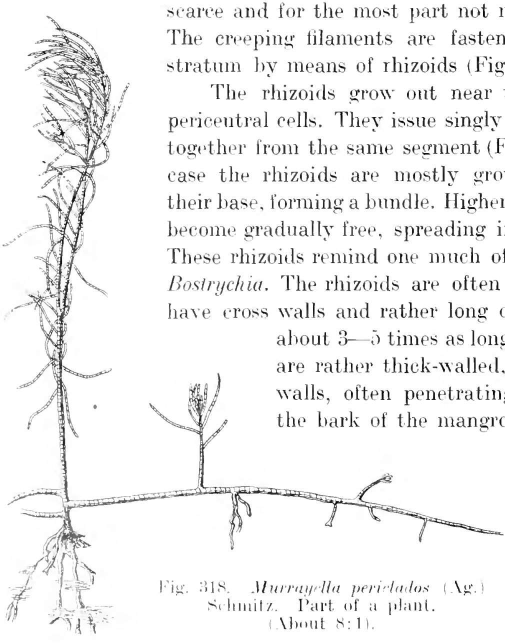


Fig. 318. *Murrayella periclados* (Ag.) Schmitz. Part of a plant. (About 8:1).

The plant has four pericentral cells and altogether lacks a cortical layer. It increases by means of an apical cell from which flat disc-formed segments are cut off. From these the side-organs issue spirally with a $^1/_4$ divergence before the segments are divided.

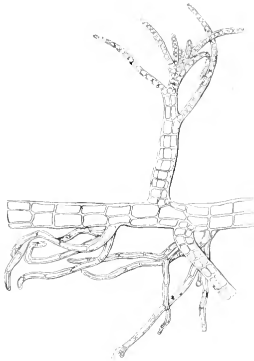


Fig. 319. *Murrayella periclados* (Ag.) Schmitz. Part of creeping filament with rhizoids and erect branches. (About 35:1).

As described by FALKENBERG the side-organs are of three different types. The most common are the unbranched, monosiphonous ones (Fig. 318); these occur especially in the basal part of the main filaments and on the whole in the less vigorous filaments. The cells in these are about 28 μ thick and 60 μ long.

The second type consists of distichously ramified branchlets (Fig. 320). The main axis in these branchlets is polysiphonous, while the side-organs are monosiphonous and these occur alternately on both sides of it.

Between these two kinds of branchlets an even transition is to be found. As pointed out by FALKENBERG it may happen that the monosiphonous, not ramified branchlets have a plurisiphonous base and, on the other hand ramified branchlets occur which are monosiphonous throughout and further, regarding the ramification of the branchlets, an even transition is also present here as branchlets with a single side-branch are found, others with two or more.

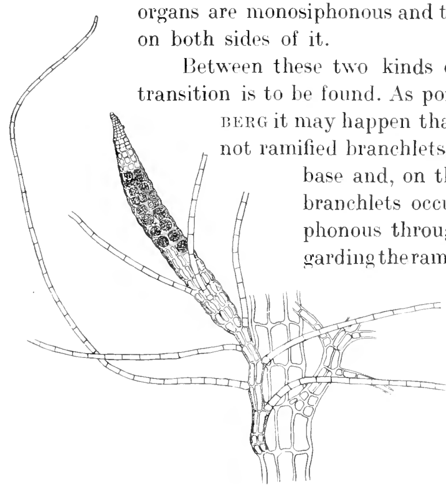


Fig. 320. *Murrayella periclados* (Ag.) Schmitz. Part af a plant with stichidium having several well-developed ramuli. (About 50:1).

Finally the third kind of side-organs consists of branches with polysiphonous

main axis and screw-formed side-organs. These branches grow out to ordinary branches and contribute to the ramificatoin of the plant.

The stichidia are found in the ends of the distichously ramified branchlets (Fig. 320). The lowest parts of these branchlets are provided with side-branches as in the case of the sterile ones. In the fertile part, on the other hand, the side branches are normally missing. Each of the four pericentral cells in each segment produces a tetrasporangium, and is covered with three cells. The tetrasporangia are about 55 µ broad, the whole stichidium about 105 µ thick; in the upper end of the stichidium a short vegetative prolongation is often developed: this consists of several small segments from which short side-branches issue spirally.

When I wrote above that the stichidia are normally destitute of side-branches, I ought, however, to have pointed out that I have found a few stichidia with well developed monosiphonous, unbranched ramuli placed in a screw (comp. Fig. 320 in which some ramuli are developed in the lower part of the stichidium). I mention this especially as FALKENBERG always found the stichidia without side-branches and maintained that just this absence of the side-branches makes *Murrayella* only slightly related to the typical *Lophothalieæ*.

Murrayella periclados was found with tetraspores in the month of January. It occurs in nearly all lagoons and bays where mangroves thrive and it grows near the surface of the sea or a little above.

This plant was described originally from specimens from St. Croix which HOFMAN BANG presented to C. AGARDH

St. Croix: Christianssted's Lagoon, Salt River. St. Thomas: Bovoni Lagoon. St. Jan: Cruz Bay.

Geogr. Distrib.: West Indies, Florida, La Guayra.

Subfam. 8. Dasyeæ.

Dasya C. Ag.

1. Dasya pedicellata Ag.

AGARDH, C., Systema Alg., 1824, p. 211. COLLINS, F., and A. HERVEY, Algæ of Bermuda, p. 136.

Dasya elegans (Mart.) Ag., Spec. Alg., vol. II, 1828, p. 117. KUTZING, Phyc. gener., p. 414, pl. 51, fig. II, Spec. Alg., p. 796. Tab. Phycolog., vol. XIV, tab. 59. HARVEY, Nereis Bor.-Am., part II, p. 60. FALKENBERG, P., Rhodomelaceen, p. 618, pl. 18, figs. 5—17.

Rhodonema elegans Martens, Reise, II, p. 641. tab. VIII.

Dasya Kützingiana Biasoletto in Linnæa, vol. XI, 1837, p. 477, pl. VIII and IX. Kützing, Phycol. gen., p. 414, pl. 51, II, figs. 1—4; Tab. Phycolog., vol. XIV, pl. 60.

For more synonyms see De-Toni, Sylloge Algarum, vol. IV, part III, p. 1201.

This fine plant is found at the islands in deeper water, about 20—40 meters, and seems at this depth to be common.

Referring for details to Falkenberg's exhaustive description I just want to mention here that the summits of each branch-system of the sympodium (the ramuli as I call them) are placed with a divergency of about $\frac{1}{4}$. Later on from the surface cells of the very early developed cortical layer numerous adventitious branchlets are developed; these are placed quite irregularly and often cover the main filaments very densely.

The stichidia are developed at the summit of the unbranched filaments of the ramuli. The stichidia are linear-lanceolate running out in an acute sterile apex; five sporangia are present in each joint.

The cystocarps are developed upon the ramuli whose basal parts then becomes polysiphonous. They are urceolate of shape, often somewhat oblique with a rather long and narrow neck.

Dasya pedicellata has been found in more open sea and rather deep water mostly in places where rather strong currents prevail. Specimens with tetraspores and cystocarps were found in the month of March.

Found in many places in the sound between St. Thomas and St. Jan, and in the sea to the north of the last mentioned island: off America Hill.

Geogr. Distrib.: West Indies, the warmer Atlantic shores of North America and Europe, Mediterranean Sea.

2. **Dasya mollis** Harv.

Harvey, W. H., Nereis Bor. Am., Part II, p. 62. J. Agardh, Spec. Alg., vol. II, pars 3, p. 1216; Till Algernes Systematik, XI Florideæ, p. 104. Kützing, F., Tab. Phycol., vol. XV, pl. 1.

A few, not very well developed specimens (No. 2131) have been found. Characteristic of this species is the rather quick tapering of the ramuli from a very robust base. In the present form (Fig. 321 a) the bases of the ramuli were about 50 μ thick. In some of the ramuli a short basal cell, nearly quadratic, was found, in others the basal cell was rather long, reaching a length of about 110 μ. In the

upper ends of the ramuli the diameter of the filaments decreases to about 7 μ, the length of the cells being about ten times the breadth.

The stichidia have a shorter or longer stalk and are placed either near the base or somewhat higher up in the ramuli. They are about 135 μ broad.

While the pericentral cells of this form were rather clearly visible in transverse sections it was not so in the case of some other specimens (my collect no. 2090). I want to mention these specimens in this place, because, regarding their outer appearance, they bear a

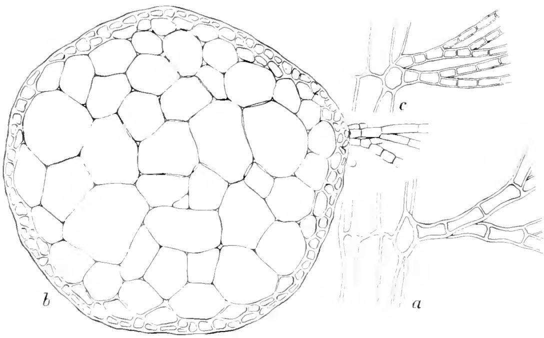


Fig. 321. *Dasya mollis* Harv. *a* part of a branch with base of a ramulus (no. 2131). *b*, tranverse section of the thallus and *c*. part of a branch with base of a ramulus (no. 2090). (*a*. about 80:1. *b*. 60:1. *c*. 150:1).

close resemblance to the above mentioned form. A transverse section of a branch of this plant (Fig. 321 b) shows a tissue of cells larger in the middle, smaller outwards, the central and pericentral cells not being visible: even in young branches these cells are not prominent. The specimens differ, too, with regard to the size and construction of the ramuli (Fig. 321 c) from the above mentioned form. At their base the cells are about 30 μ thick only, and short, too, not much longer than broad, growing gradually longer higher up in the ramuli. The stichidia are placed near the base of the ramuli with a single short basal cell only. This plant does most probably represent another species, but having had so very little material of related species or none at all at my disposal, I have not been able to make any comparison and so I prefer to leave it be unnamed.

Fig. 322. *Dasya caraibica* nov. spec.
Part of the thallus.
(About natural size).

Both forms were dredged in deep water (about 30 meters) and both were found at:

St. Jan: off Cruz Bay.

Geogr. Distrib. *Dasya mollis* occurs at the warmer parts of the American Atlantic coast.

3. Dasya caraibica nov. spec.*)

Frons ca. 20 cm alta, rosea-coccinea, teretiuscula, filiformis, quoquoversum ramosa, articulata, polysiphonia, singulis articulis e cellulis pericentralibus quinis circa cellulam centralem positis formatis, cellulis ca. 400—500 μ longis. In adultiori parte plantarum frons corticata, supra ramulosa, ramulis in superiori parte ramorum aggregatis ocellatisque, infra nuda.

Ramuli monosiphonii, identidem pseudodichotomi, ca. 4 mm

*) I have had some doubts whether this plant most rightly was referable to *Dasya ramosissima* as a variety only or to be considered as a proper species, having had no authentic material of related species to compare with. I am much obliged to Mr. Frank S. Collins for having compared one of my plants with specimens in his herbarium and for having written to me that he could not identify it with anything he knows. Mr. Collins has also sent my specimen to Dr. Howe who expressed his view in a similar way.

longi, in parte basali ca. 24 μ crassi ad apicem filorum versus gradatim longiores, apice rotundato, ca. 8 μ lato.

A rather large and elegant plant of dark rosy-purple colour when dry and reaching a heigth of up to 20 cm. The specimens are much branched on all sides forming dense tufts; the branchlets become shorter towards the summit giving the plants a pyramidal outline. The upper parts of the branches and branchlets are covered by ramuli. These are especially densely placed at the ends of the branchlets giving them an ocellate appearance. The basal part of the branchlets and branches are bare. The principal branches are about 1 mm thick, while the branchlets are only about 100 μ thick.

Fig. 323. *Dasya caraibica* nov. spec. *a*, part of the thallus, with two young plants of *Acrochætium opetigenum* Borgs. *b*, summit of a plant. (*a*, about 60 : 1. *b*, about 260 : 1).

The cortical layer is incompletely developed upon the younger branches and branchlets being here limited to a single or a few hyphæ running down in the furrows between the pericentral cells; upon the thicker main filaments, on the other hand, a coherent cortical layer is found.

The plant has five pericentral cells surrounding a rather large central cell. The pericentral cells reach a length of about 300—400 μ in the younger parts of the branchlets.

The ramuli are placed with a divergency of about 1/2; they are slender and long, often reaching a length of 4 mm. At their base they have a large subquadratic cell, about 50 μ broad and 60—70 μ long, partly immersed in the main stem (Fig. 323 a). The cells in the ramuli are shorter and thicker at their base, longer and thinner upwards. In specimens of my collection no. 1842, upon which I especially have based my examination, the ramuli were about 24 μ broad in the basal part and their filaments had nearly the same breadth somewhat higher up, but then

the filaments taper evenly upwards their ultimate summits reaching only a breadth of 8 μ. The cells are often more than 200 μ long. The summits of the filaments are obtuse. The ramuli are repeatedly pseudodichotomously ramified; the monosiphonous branches issue with acute angles. The whole ramuli are upwards directed and at the summit of the branches and branchlets somewhat incurved.

The specimens examined were all sterile.

The *Acrochætium opetigenum*, occurring upon *Dasya elegans* and described on p. 38 of the present volume, was very common, too, on this species (vide Fig. 323 *a*, two young specimens are seen).

This plants reminds one as to its whole appearance and ramification rather much of *Dasya ramosissima*, but it differs greatly from this species by its much longer and slender ramuli with longer cells and obtuse summits.

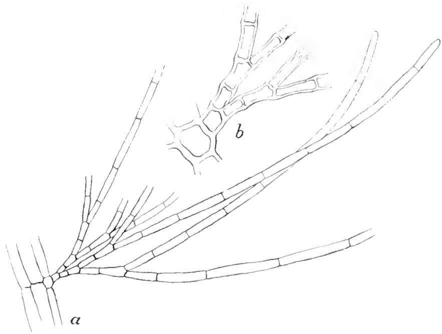


Fig. 324. *Dasya spec.* *a*, part of the thallus with a ramulus. *b*, base of a ramulus more magnified (nearly the same enlargement as that of Fig. 323 *a*). (*a*, about 30:1, *b*, 65:1).

The large basal cell is not so markedly develo[illegible] n *Dasya ramosissima*, and the cortical layer is less and differently, too, developed in this species. Also the rosy-red colour of our plant differs from the more brownish of *Dasya ramosissima*.

Also with *Dasya Harveyi* our plant may be compared; but this has, according to Falkenberg, p. 625, four pericentral cells, its ramuli are slender and are not ocellate at the summits of the branches.

I want yet to mention a form here (my coll. no. 1790) of which only a single plant was found. This had nearly the same rosy-red colour and whole habitus as the above-mentioned form with exception of the ramuli which were much more robust (Fig. 324): at their base the cells were 31 μ thick, somewhat higher up their diameter increased to about 60 μ, the following cells tapering gradually up-

wards to 11—27 μ in the various filaments. The basal cell in the ramuli was not so marked and proportionally smaller than in the first-mentioned form. The ramuli were much incurved especially in the upper end of the branches.

This plant has given me much trouble. I suppose, having not seen any typical specimen af HARVEY'S plant, that it comes rather near to *Dasya ramosissima*, but it differs from this by its rosy-red colour and different habitus. From *Dasya caraibica* it differs not only concerning the structure and shape of the ramuli as mentioned above, but also by the fact that *Acr. opetigenum*, so common on *Dasya caraibica*, was not found on this plant. As the *Acrochætium*-species often are closely connected to a single species this indicates furthermore that this form most probably has nothing to do with *Dasya caraibica*.

At the islands *Dasya caraibica* was dredged only in deep water, about 30—50 meters and in rather open sea in places with strong currents.

Found in the sound between St. Thomas and St. Jan in several places.

4. Dasya ocellata (Gratel.) Harv.

HARVEY in Hooker, Brit. Flora, vol. II, part 1, p. 335; Manual, p. 97; Phycologia Brit., pl. 40. KÜTZING, FR., Spec. Alg., p. 796. Tabulæ Phycolog., vol. XIV, pl. 61. J. AGARDH, Spec. Alg., vol. II, p. 3, p. 1207. Zanardini, Icones Phyc. Adriat., pl. 42 A. FALKENBERG, P., Rhodomelaceen, p. 622, pl. 18, figs. 1—4.

Ceramium ocellatum Gratel., Diss. no. 2. fig. H (non vidi).

Hutchinsia ocellata Ag. Syst., p. 157.

Dasya simpliciuscula Ag., Spec., vol. II. p. 122.

The accompanying figure (Fig. 325) of the apex of a main filament shows the sympodial growth of the plant. We see the vigorous side-branch in the stage of bending the apex of the mother branch aside, quite in the same way as the last mentioned has pushed aside the following branch and so on. Of each branch system the basal segment only becomes polysiphonous forming a segment in the main stem; the remaining parts of the pushed-aside branches form the ramuli.

According to FALKENBERG each branch-system has 5—7 seriate side-branches, in my specimens I have mostly found 5 only. The first side-branch, the one constituting the continuation of the main filament, is placed upon the first segment, the following upon every second one. These branches grow out to long monosiphonous filaments

about 15 μ thick. At the summit of the main filaments the ramuli are bent upwards covering the growing point entirely.

The cortical layer is highly developed, covering the stems quite densely from base to summit. The specimens found form dense dark red-brown tufts about 4 cm high or even more. They are richly ramified and on the whole vigorously developed. The breadth of the branch-system with the covering ramuli is nearly a half cm.

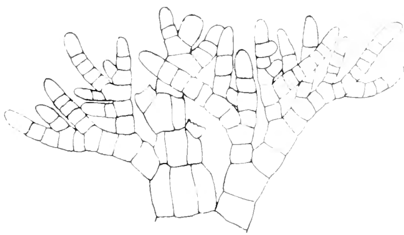


Fig. 325. *Dasya ocellata* (Gratel.) Harv. Apex of plant. (About 350:1).

The stichidia are cylindrical to conical, running out in a shorter or longer sterile point. The stalk is composed of 1 to 7 or more cells.

Dasya ocellata was found growing upon the roots of the mangroves to which it is fastened by means of a small disc. It was growing in a sheltered locality and in shallow water. It had tetrasporangia in the month of January.

Only found once, St. Thomas: Bovoni Lagoon.

Geogr. Distrib.: Bermuda, Mediterranean Sea, Morocco, warmer parts of the European Atlantic coast.

5. Dasya corymbifera J. Ag.

J. Agardh, In Historiam Alg. Symbolæ (Linnæa, vol. 16, 1841, p. 31); Spec. Alg., vol. II, p. III, p. 1219. Crouan, Fl. Finistère, p. 159. Zanardini, G. Iconogr. Phyc. Med.-Adriat., vol. II, pl. 59.

Dasya arbuscula var. *mucilaginosum* Crn., Alg. mar. Finistère. No. 286.

Dasya venusta Harv., Phyc. Brit., pl. 225.

The specimens reach a heigth of about 5—7 cm. They have 5 pericentral cells; the cortex is not much developed, the central cells being clearly seen through it. The ramuli are monosiphonous with thicker, 50—60 μ thick, cells at their base, thinner upwards, becoming very slender at their summit. The branches of the ramuli are spreading in all directions.

Tetrasporic plants were the only ones found. The stichidia are developed on the summit of a branch in the ramuli. They have gene-

rally a short stalk composed of two cells. The stichidium is conical in shape. At the upper end it often runs out in a rather long sterile monosiphonous prolongation. The stichidia are about 300 μ long and about 90 μ broad.

This plant was found in shallow water in sheltered places epiphytic upon *Acanthophora*: further in the open sea in deeper water down to a depth of about 30 meters. It had tetrasporangia in the month of March.

St. Croix: Off Frederikssted. St. Thomas: Bovoni Lagoon. St. Jan: off Cruz Bay.

Geogr. Distrib.: West Indies, Atlantic coast of Europe and North Africa, Mediterranean Sea.

Heterosiphonia Mont.

1. **Heterosiphonia Wurdemanni** (Bail.) Falkenberg.

Falkenberg, P., Rhodomelaceen, p. 638. pl. 16, fig. 11.

Dasya Wurdemanni Bailey, Harvey, Nereis Bor.-Am., vol. II, p. 64, tab. XV, C. Kützing, Tab. Phycol., vol. XIV., pl. 81. J. Agardh, Spec. Alg., vol. II, p. III. p. 1191. Zanardini, Icon. Phycol. Adriat., vol. II, pl. 53, A.

Cfr. De Toni's remarks concerning *Dasya rigidula* (Kütz.) Ardiss. in Sylloge Alg., vol. IV, sect. III, p. 1207.

The essential differences between *Heterosiphonia* and *Dasya* consist in (1) producing two or more segments to the sympodial main axis in each branch-system in *Heterosiphonia* compared with the one in *Dasya*: (2) placing the free summits of each branch-system distichously alternate on both sides of the main axis, and (3) the presence of a more or less pronounced dorsiventrality.

Heterosiphonia Wurdemanni creeps upon larger algæ, stones and shells and is fastened to the substratum by means of the rhizoid-like ends or even discs often found in the summit of the branches (cp. Figs. 326 *a*, 328 *b*). It forms small roundish spongy clumps two to three cms high. Because of its mostly very squarrose ramification it becomes easily entangled between other algæ.

The main branch carries, besides the branch constituting the continuation of the sympodium and placed upon the second segment of the main branch, another branch issued from the fourth segment. This branch is bent upwards, several times pseudodichotomically ramified with divaricate and squarrose branches. Commonly the free

part of the branch is monosiphonous except the basal segment, the third one of the whole branch, which is polysiphonous; in vigorous plants the fourth and fifth segments, too, are polysiphonous. The plant is quite without cortex.

FALKENBERG has pointed out that in the Mediterranean Sea he has found two different forms namely a robust and very squarrose

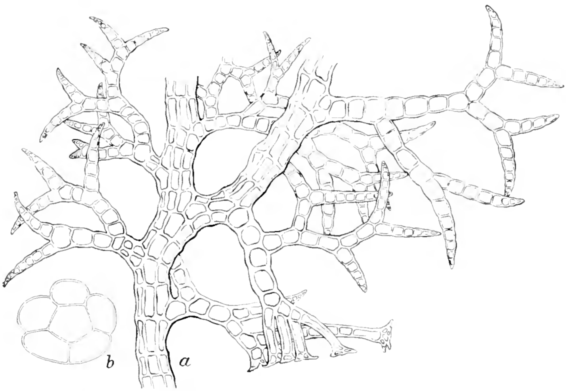


Fig. 326. *Heterosiphonia Wurdemanni* (Bail.) Falkenb. var. *typica*. *a*. part of the thallus with rhizoids developed from the summit of the ramuli. *b*, transverse section of the thallus. (*a*, about 180:1; *b*, about 300:1).

form which is like the original specimens of HARVEY from Key West, and a more slender and not so squarrose form. Both forms have been found in the West Indies (cp. Figs. 326 and 327).

Fig. 326 gives a representation of a part of the first-mentioned form. As seen in the figure the ramification is very squarrose. The branches are rigid, often curved with obtuse or acute angles and entangled between each other. They are composed of rather short cells, in the basal part about 60 μ broad and about 70 μ long, tapering evenly upwards and running out into acute, mostly curved apices; towards the top the cells at the same time become shorter.

In the main axis the segments have 5 pericentral cells in my plants (Fig. 326 *b*); FALKENBERG found 4—6 in his specimens. Of these cells the three are lying on the upper dorsal side, the two on the ventral side.

The other form (cp. Fig. 327) is much more slender and of a

softer consistence. The ramification of the branches is scarcer, the branches are slender with thinner and longer cells; the unbranched summit of the first branch in the branch-system is especially much elongated. In the basal part of the monosiphonous ends of these branches the cells are about 40 μ thick and their length about 70 μ. Towards the top the cells become somewhat longer (about 120 μ), tapering at the same time evenly to the summit where the breadth is about 25 μ. The uppermost end of the filaments is often a little swollen or it becomes rhizoid-like (Fig. 328 *b*).

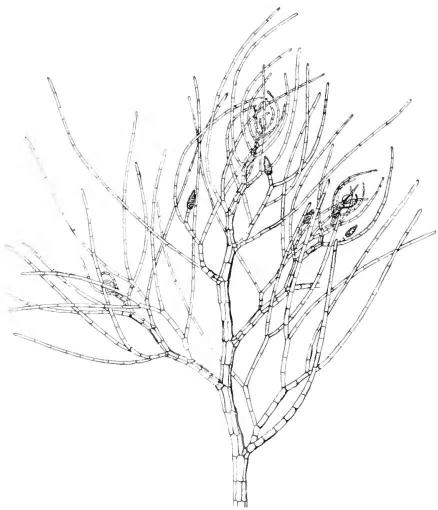


Fig. 327. *Heterosiphonia Wurdemanni* (Bail.) Falkb. var. *laxa* n. var. Upper part of the thallus with young stichidia. (About 35:1).

In this form the polysiphonous axis has always 4 pericentral cells and never more (Fig. 328 *c*). While all the gatherings of the squarrose form were sterile, this one had stichidia with ripe tetraspores (Fig. 327). The stichidia (Fig. 328 *a*) are placed at the ends of one of the ramifications of the second branch. They are acute, subcylindrical of shape with broadly rounded base. In the cylindrical part they are about 110 μ thick. They have a longer or shorter, monosiphonous stalk composed of a variable number of cells up to ten.

My description above proves that the two forms are very different, and Falkenberg, too, points out that perhaps we have to do with two different species. As they agree in so many respects I prefer to consider them only as varieties of the same plant. The first one, the squarrose form, according to Falkenberg being like the

original specimens in HARVEY's Herbarium, must be considered as the var. *typica*. The other more slender and softer plant I propose to call var. *laxa*.

FALKENBERG suggests, not having made any observations regarding the localities in which the two forms grow, that the var. *typica* ought to originate from shallow water while the var. *laxa* on the other hand ought to be a deep sea form. My observations have not quite verified this supposition. To be sure the var. *typica* is often found in shallow water in exposed places with strong light, but I have also dredged this form once in a depth of ten meters and another time in about twenty meters. As to the var. *laxa* this was once found in shallow water in a lagoon growing in the shade of the mangroves and therefore at a place where it might be exspected to occur, but another time it was gathered in shallow water behind Long Reef at Christianssted, a rather exposed place with strong light.

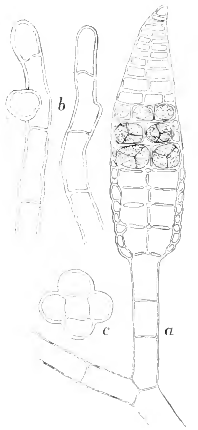


Fig. 328. *Heterosiphonia Wurdemanni* (Bail.) Falkb. var. *laxa* n. var. *a*, stichidium with ripe tetrasporangia; in the basal part they are emptied. *b*, ends of ramuli transformed into rhizoids. *c*, transverse section of the thallus. (About 180:1).

The specimens with tetraspores were gathered in the month of January.

Heterosiphonia Wurdemanni is often found upon other larger algæ. Between its branches *Falkenbergia Hillebrandii* is often entangled.

Heterosiphonia is most probably a common species along the shores of the islands; I have gathered it only at the shores of St. Croix.

St. Croix: Christianssted's Lagoon, Long Reef, White Bay, Casavagarden.

Geogr. Distrib.: West Indies, Key West, Cadiz, Mediterranean Sea.

Dictyurus Bory.

1. Dictyurus occidentalis J. Ag.

AGARDH, J., Nya alger från Mexico (Öfversigt af Kungl. Vet.-Akad. Förhandl., 1847, p. 17); Spec. Alg., vol. II. 3, p. 1243. KÜTZING, F., Spec. Alg., p. 673; Tab. phycol., vol. XII, t. 64.

Unfortunately all the material preserved in spirit of this

highly interesting plant seems to have been gathered in a season where the plant had stopped its growth, as no young branches or summits of thallus are to be found in the material brought home. Therefore I am able to give only a rather fragmentary description of the construction of this plant which FALKENBERG just mentions. On the other hand, FALKENBERG gives a very detailed description of the old world species, *Dictyurus purpurascens*.

Dictyurus occidentalis forms dense tufts, up to 10 cm or more and is fastened to the substratum, rocks, stones etc. by means of small discs and rhizoids growing out from the basal part of the stem. This often very irregularly shaped base, from which new erect stems arise, grows together with bases of the neighbouring plants forming in this way rather large tufts. From this basal part the erect more or less branched shoot-systems arise. These are mostly bare in the lower part bearing merely the remaining basal parts of the aside-pushed free ends of the branch-systems of which the plant is constructed. These remnants are found alternately and distichously on both sides of the terete stem. Higher up we find the characteristic reticular tissue originating from the upper ends of the pushed aside free branches of the sympodium surrounding the central stem like a closed spiral staircase. A transverse section of the stem shows four pericentral cells surrounded by a thick cortical layer (Fig. 329).

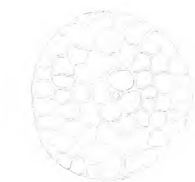


Fig. 329. *Dictyurus occidentalis* J. Ag. Transverse section of the main stem. (About 60:1).

As *Dictyurus occidentalis*, with regard to the fully developed tissue, bears such a close resemblance to *Dictyurus purpurascens* I feel quite convinced that its development takes place in a very similar way. In *Dictyurus purpurascens* we have, as described by FALKENBERG, sympodial growth of such a kind that the branch which constitutes the continuation of the main axis is developed upon the second segment of the mother branch, giving in this way two segments to the sympodial stem. Besides this first branch whose purpose is the continuation of the sympodium, the branch pushed aside bears yet three side-branches. These three branches are sympodially ramified so that each branch-system bears only a single side-branch, namely that intended for constituting the continuation of the axis. This branch is placed upon the second segment of the mother branch

and, as the ends of each of the branches are placed distichously alternately on both sides of the main axis, the whole sympodium gets a very regular, feather-like appearance. An exception from this ramification is only made by the second side-branch (the first of the three) this being firstly branched once, the two branches originating from this branching are then sympodially ramified in the way described above. Falkenberg gives very fine illustrations (l. c., pl. 17 figs. 13, 14) of these lateral sympodia. The main axes of these four sympodially ramified branch systems become polysiphonous with the exception of their uppermost ends. From the monosiphonous side-branches of these lateral sympodia the net is developed. This is formed in such a manner that outgrowths emerge from two neighbouring filaments and grow together after which the outgrowths are separated by walls from the mother-cells. But this growing-together process is not restricted to filaments from the same group of sympodia, for the peripheral filaments of one group of sympodia connect themselves with those of other groups (cp. Fig. 331 *a*).

Fig. 330 *a* shows a transverse section of the thallus of *Dictyurus occidentalis*. This is seen to be quadrangular with concave sides; but, because of the spiral arrangement of the net, this is cut through and wanting at the one side, and further, because of the very thick cortical layer of the main stem, the base of the two branch systems, drawn in the figure, is not clearly seen. When Falkenberg, regarding *Dictyurus occidentalis*, says, l. c., p. 681, "dass an dieser überhaupt schwächeren und schlankeren *Dictyurus*-Art die Hauptaxen der Seitensympodien — an der sterilen Pflanze wenigstens — durchweg monosiphon bleiben" it does not correspond with my observation (cp. Fig. 330 *b*) the main axes in my specimens being polysiphonous with four pericentral cells. It is only in small and very feebly developed branches that I have found the side-branches throughout monosiphonous. And besides it is so in the case of the original specimens from Mexico, at any rate in that specimen I have examined. Of the four main axes in each branch-system the two run out in the prolonged corner of the net, the other two end in about the middle of the concave side (Fig. 330 *a*). And here *Dictyurus occidentalis* shows a marked difference from *Dictyurus purpurascens* according to Falkenberg's description. In the latter we have between the larger acute corners smaller obtuse edges to which the polysiphonous axes run out. This I have not found in my material; between the high-

ly protruding four corners the sides of the net are evenly concavely rounded with no processes or edges in their middle (Fig. 330 *a*). The edges protrude into rather long, at the farthest end nearly cylindrical, elongations with a large, circular opening; the borders of these are adorned by small acute processes (Fig. 330 *a*). The very protruding corners make the edges of the plant highly sinuate (Fig. 331 *b*).

Fig. 330. *Dictyurus occidentalis* J. Ag.
a, transverse section of the thallus (comp. text).
b, part of the plurisiphonous main axes.
(*a*, about 10:1, *b*, 100:1).

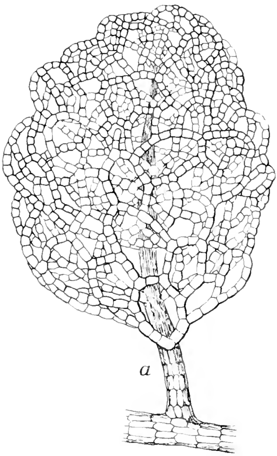
Fig. 331 *a* shows a part of a poorly developed shoot. In this the growing-together of the summit of the filament in one branch-system with the filaments of another one above is clearly demonstrated.

The cells in the net are about 60—70 μ thick and $1\frac{1}{2}$ times as long.

All the material gathered was sterile.

I have been able to compare my specimens with the original material of this species, collected at Vera Cruz by Liebman and being preserved in the Botanical Museum, Copenhagen. The original specimens belong to a very small and tiny form reaching a heighth of about 5 cm only. As mentioned above the axes of the sympodia, bearing the net, are, in the specimens I have examined, monosiphonous.

This plant has been found partly in shallow water (about one meter) in a rather exposed place and partly in deep sea at a depth of about 30 meters.



St. Croix: White Bay. St. Thomas: In the sea to the west of Water Island.

Geogr. Distrib.: Mexico, West ndies.

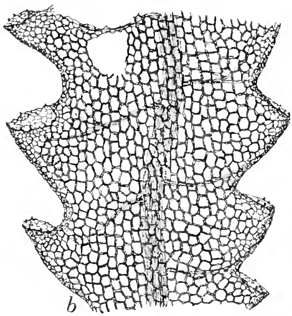


Fig. 331. *Dictyurus occidentalis* J. Ag.
a, part of a small poorly developed erect shoot showing the growing together of the net. *b*, part of the thallus. (*a*, about 20:1; *b*, 6:1).

Genera incertae sedis.

Falkenbergia Schmitz.

1. **Falkenbergia Hillebrandii** (Bornet) Falkenb.

Falkenberg, P., Rhodomelaceen, p. 689. Børgesen, F., Some new or little known W. I. Florideæ. II, (Bot. Tidsskr., vol. 30, p. 199). Collins and Hervey, Alg. Bermuda, p. 122.

Polysiphonia Hillebrandii Bornet in Ardissone, Phycologia Mediterranea, I, p. 376.

The genus *Falkenbergia* is remarkable for its 3 pericentral cells and especially for its way of branching, this being, as pointed out by Falkenberg, very different from the two ordinary ways of branching, either exogenous or endogenous, in the *Rhodomelaceæ*. The branching takes place in such a manner that a cupola-formed outgrowth is given off from the middle of one of the pericentral cells; this outgrowth is soon separated from the mother cell by a wedge-shaped wall becoming the apical cell of the new branch (Fig. 332 *c*). The

basal cell, the remaining part of the pericentral cell, is divided into a central and three pericentral cells becoming the basal segment of the branch (Fig. 332 d). In this way the branch is placed upon the middle of a segment and not near the upper walls between the segments as always in the case of the *Rhodomelaceæ*.

The growth in length of the filaments takes place with the aid of a rather large conical apical cell (Fig. 332 a), from which the lowest part is gradually cut off by means of a horizontal wall into flat, disc-like segments. These cells are again divided by vertical walls into the small central cell and the three pericentral cells.

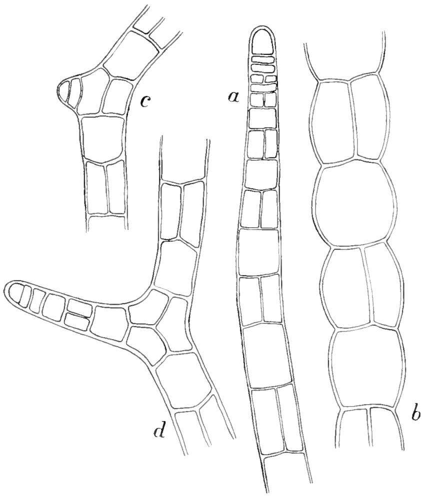


Fig. 332. *Falkenbergia Hillebrandii* (Bornet) Falkb. *a*, summit of a filament. *b*, part of a moniliform filament. *c* and *d*, branching of filaments. (About 270:1).

Epiphytic upon other algæ, the irregularly ramified and twisted filaments of *Falkenbergia Hillebrandii* forms densely matted tufts up to a height of two to three cm. The ramification is very irregular (Fig. 333 *A*), rather long parts of the filaments often being undivided, whilst in other ones the ramifications occur close together; large spongy clumps being formed in this way. It is fixed to the host plant by means of irregularly shaped, often disc-like haptera (Fig. 333 *F*, *G*) emerging from the lowest, more or less horizontally growing filaments. These as well as the haptera are thick-walled in contrast to the otherwise rather thin walls of the thallus.

There was not any kind of reproductive organs found in my specimens: Collins has succeeded in finding tetraspores. According to him »they are tripartitely divided and formed from one of the pericentral cells of a ramulus quite as in *Polysiphonia*, but occurred singly

not in series". In *Falkenbergia vagabunda* the sporangia are formed directly from a pericentral cell and no covering cells are present. The contents are firstly divided in two parts and these two parts are again divided into the four spores (cfr. FALKENBERG, l. c., p. 691).

While the form first discovered by me and mentioned in my paper quoted above was rather a small one, the filaments reaching only a diameter of about 30—40 μ, I have later on found a much more robust form in which the filaments often had a diameter of 50 to 60 μ. In this form the segments were now and then very swollen in their middle, the whole filament in this way getting a moniliform appearance (Fig. 332 *b*)*).

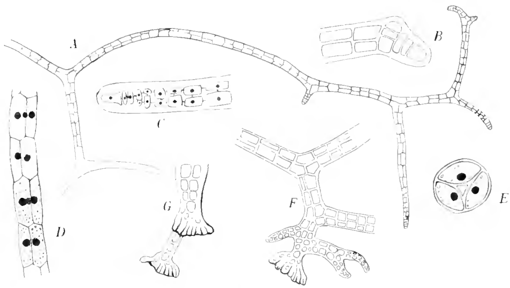


Fig. 333. *Falkenbergia Hillebrandii* (Bornet) Falkb. *A*, part of the thallus (25:1). *B* and *C*, summits of filaments, in *B* with a new branch (150:1). *D*, part of a filament (120:1). *E*, transverse section of the thallus (150:1). *F* and *G*, hapters (65:1).

This species occurs in shallow water near the shore in sheltered as well as in more exposed places. It is, as mentioned above, found epiphytic on or intertwisted among other littoral algæ as *Gelidium*, *Chamædoris annulata*, *Heterosiphonia Wurdemanni*, *Dasya ocellata* etc. often forming together with these large spongy tufts.

At the islands it seems to be a common species.

Geogr. Distrib.: Mediterranean Sea, Canary islands, Bermudas, Barbadoes.

Cottoniella nov. gen.**)

Thallus ex filamentis infra decumbentibus rhizoideis substrato adfixis, dein assurgentibus, erectis compositus, structura dorsiven-

*) According to YENDO (Bot. Magaz., vol. XXX, p. 62) our form is very like the Australian *F. rufolanosa* (Harv.) Schmitz; most probably this plant and *F. Hillebrandii* are forms of the same species.

**) I have great pleasure in naming this interesting plant after my English colleague and friend, Mr. A. D. COTTON of Kew.

trali, subcomplanatus, in juvenili statu ex una cellula centrali et quattuor pericentralibus compositus, postea cortice tectus.

Crescentia terminalis; cellula apicalis major, transverse septata. Filamenta in inferiori parte decumbentia, rhizoideis substrato adfixa dein assurgentia, subrecta, in superiori parte arcuata.

Thallus infra nudus, supra in latere dorsali (convexo) ramulis monosiphoneis in duas series alternantibus, instructus. Cellulæ ramulorum cylindricæ.

Ramificatio adventitia, ramis sæpe prope ab latere ramulorum ortis.

1. **Cottoniella arcuata** nov. spec.

Frons ca. 8 cm alta. Rami adulti ca. 200—250 μ lati, ramulis usque ad 1 mm longis, ex cellulis cylindraceis ca. 175 μ longis et 7—20 μ latis compositis.

The basal part of the plant consists of decumbent filaments fixed to the substratum (*Halimeda* etc.) by means of rhizoids (Fig. 336 *b*). The rhizoids are not separated by walls at their outgrowth from the mother-cell, but walls occur in the more or less cylindrical stalk; they end in a small multilobed disc. The rhizoids are rather vigorous with thick undulated walls; the cylindrical part is about 30 μ; the wall about 12 μ broad.

The decumbent filaments show no marked differences from the erect ones, their summits often bending upwards and those of the erect filaments bending downwards. The decumbent filaments as well as the erect ones with the exception of the youngest parts are covered by a cortical layer. The thickest filaments I have met with had a diameter of 200—250 μ.

The erect filaments are arch-shaped in their upper ends (Fig. 334), bearing a series of branchlets with limited growth placed in zigzag in two rows along the dorsal, convex sides (336 *a*).

The filaments increase by means of a large, conical-cylindrical apical cell (Fig. 335 *a*, *b*) from which disc-shaped, thin segments gradually are cut off. These segments remain undivided for some time, I have counted about 6 of them. They increase gradually in length and are then divided into a central and four pericentral cells. Shortly after the segments have begun to be divided the branchlets with limited growth begin to grow out from the central cells (Fig. 335 *a*, *b*) and are seen as small cupola-outgrowths on the convex side

of the filaments. A branchlet is given off from each segment so, that they are placed alternately on both sides of the median line of the main branch forming in this way two series on both sides of it upon the dorsal side of the branch (Fig. 336 a).

The branchlets tend towards the top (Figs. 334, 335*a*) issuing from the mother branch with acute angles; they are monosiphonous, unbranched and, when fully developed, composed of long cylindrical cells about 20 μ thick and often more than 10 times as long, only tapering slightly towards the summit. The whole branchlet reaches a length of about 1200 μ. The basal cell in the branchlets is short, nearly quadratic, and becomes more or less immersed in the cortical layer; the summit of the branchlet is obtuse. The branchlets are rather persistent; in the older, lower part of the filaments they are dropped, leaving only the basal cells.

Fig. 334. *Cottoniella arcuata* nov. spec. Upper parts of filaments. (About 45:1).

At some distance from the summit when the branchlets are already much developed the adventitious branches with continuous growth are formed (Figs. 334, 335 *a*). These contribute to the ramification of the plant and are issued now and then without any more definite distance between them. They are mostly issued at the side of a branchlet (Fig. 335 *c*). I have most frequently found them placed

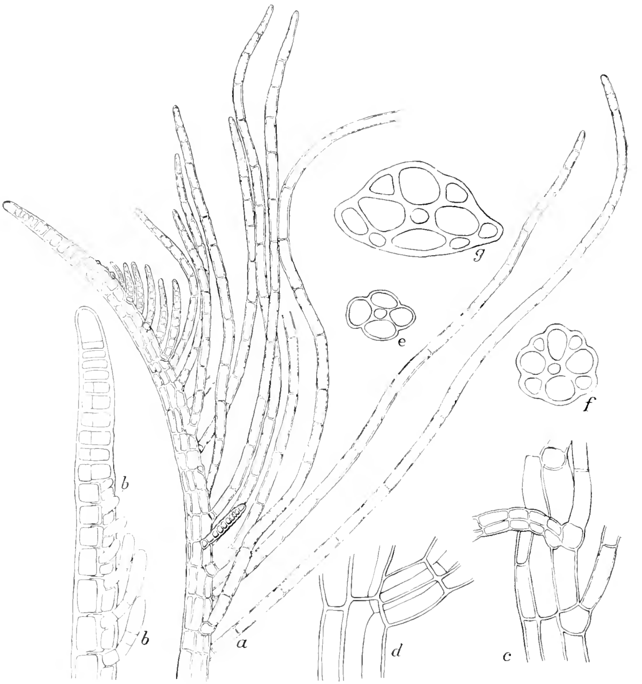


Fig. 335. *Cottoniella arcuata* nov. spec.
a, upper part of a filament with branchlets and a young branch. *b*, summit of a filament showing the endogenous origin of the branchlets. *c*, branch issued at the side of a branchlet. *d*, base of a branch. *e*, *f*, *g*, transverse sections of the thallus.
(*a*, about 220:1. *b*, 450:1. *c* and *d*, 320:1. *e*—*g*, 250:1).

on the left side of the branchlet, but probably this is only by chance, for I have also found them placed on the right side; sometimes, too, a branch happens to be issued from a segment without any branchlet. In the first stage of development the branches are very like the branchlets, but longitudinal walls are soon developed, dividing the segment into a central and four pericentral cells.

The segments are, immediately after they are cut off from the apical cell, very short, but gradually they increase in length becoming

in the full grown filaments about 2—4 times as long as broad; for instance a filament was 50 μ thick and the segments 150 μ long.

The dorsiventrality which is clearly expressed by the curved summit of the plant and by the arrangement of the branchlets upon the convex dorsal side of the filaments is also seen upon the transverse section of the filaments, these having a more or less pronounced bilateral appearance (Fig. 335 *e*—*g*). The older parts of the plant become, as mentioned above, gradually covered by a cortical layer. In the younger parts of the filaments this does not form any coherent layer; in the older parts, especially in the basal filaments, it covers the whole filament densely. In spite of a thorough search I have not succeeded in finding any young stages showing the development, but I think we have to do with a cortical layer formed by hyphæ. The fig. 336 *c* shows the first stages found. At the top on the left side of the figure a hypha has grown down from the uppermost pericentral cell and, after having passed a segment, it has grown together with the upper end of the pericentral cell of the next segment being at the same time divided into two cells. On the right side of the figure another hypha has grown down along two segments and has been divided into 4 cells.

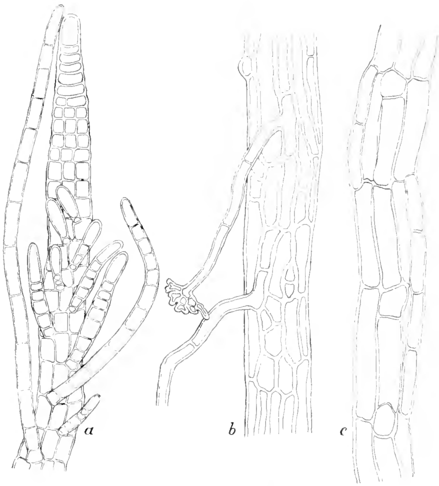


Fig. 336. *Cottoniella arcuata* nov. spec. *a*, summit of a filament seen from the dorsal side, showing the zig-zag arrangement of the branchlets. *b*, part of a decumbent filament with rhizoids. *c*, part of a filament showing the development of the cortical layer. (*a*, about 350:1. *b*, 80:1. *c*, 240:1).

It is much to be regretted that there was not found any kind of

reproductive organs among the specimens collected, these being quite sterile.

If we now ask to which of the forms of *Rhodomelaceæ* our plant come nearest this question is, of course, difficult to answer as long as we do not know its reproductive organs. We must surely look for its nearest relatives amongst the dorsiventral forms of the *Rhodomelaceæ*, even if it does not seem to be so very closely related to any of the known forms. The arrangement of its branchlets in two rows on the dorsal side of the stem bears a resemblance to that in *Cliftonia*. We ought also to compare it with forms of *Bostrychia* and related genera.

It was found in very small quantities intermingled between the *Callithamnion* spec. mentioned above on p. 220—1.

Only dredged once in deep sea at a depth of about 20 fathoms.

St. Thomas. In the sea to the west of Water Island: off Great Crum Bay.

Fam. 3. ***Delesseriaceæ.***

Subfam. 1. Sarconemieæ.

Tænioma J. Ag.

1. **Tænioma perpusillum** J. Ag.

Agardh, J., Nya alger från Mexico (Öfvers. k. Vet.-Akad. Förhandl., 1847); Spec. Alg., vol. II, p. 3, p. 1257.

Tænioma macrourum Thuret in Bornet et Thuret, Notes algolog., fasc. 1, pag. 69, pl. XXV. Falkenberg, P., Rhodomelaceen, p. 709, pl. 15, figs. 21—29.

Polysiphonia nana Kütz., Tab. phycol., vol. XIII, p. 10, pl. 29.

Already in "Notes algologiques" Thuret expressed his doubt as to the specific difference between the Mediterranean form and the Pacific one. In "Les Algues de P. K. A. Schousboe" Bornet, after having examined specimens of *Tænioma perpusillum*, arrives at the conclusion that the two species cannot be distinguished from each others. On the other hand Falkenberg, l. c. p. 709, maintains the difference between the two plants basing his conclusion especially upon the non-existence in *Tænioma perpusillum* of the long monosiphonous hair-like filaments which crown the summits of the branchlets in *Tænioma macrourum*. Not having had any specimens of the

Pacific form at my disposal because the ones collected by LIEBMAN most probably have been kept in J. AGARDH's Herbarium in Lund, I have not been able to compare the two plants, but I am most inclined to think that BORNET is right.

The structure of this plant has been examined by FALKENBERG, l. c.

In its way of growing it bears a close resemblance to *Herposiphonia tenella* having a creeping, prostrate main stem with indefinite growth from which erect branches arise (Fig. 337 *a*). The main stem is terete and a transverse section shows four pericentral cells. From its ventral side rhizoids are issued downwards; these often have a long stalk with no walls or a few ones, ending in a small more or less lobed disc.

On its dorsal side the main stem carries more or less ramified branches with definite growth and placed in

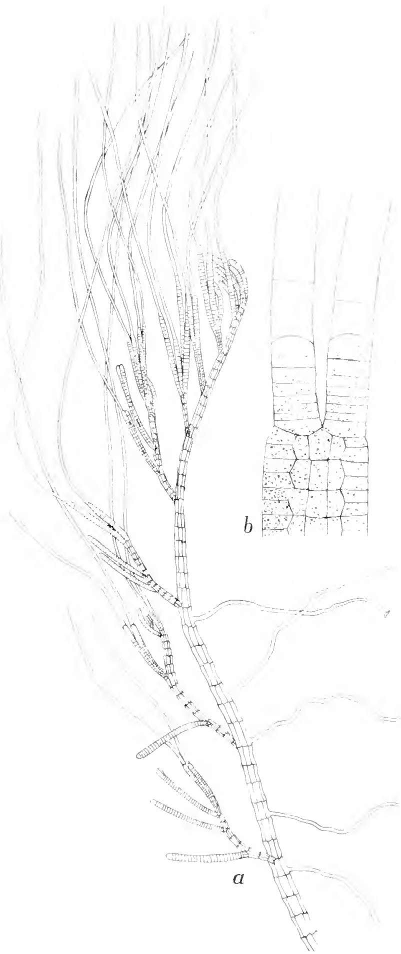


Fig. 337. *Tænioma perpusillum* J. Ag. *a*, part of a plant. *b*, upper part of the flat branchlet with basal part of the hairs. (*a*, about 30:1, *b*, 270:1).

two rows: now and then one of these branches get indefinite growth contributing in this way to the ramification of the plant.

The main stem increases by means of an apical cell from which flat segments are cut off gradually: from these the branches grow out, even before the segments are divided. The branches in my plant issue mostly from every sixth segment, and it is only in a very few and rare cases that the space between the branches may be either shorter or longer than the above mentioned. FALKENBERG found, in his Mediterranean plant, about four segments between the branches.

The segments are first divided into two cells, one large and one small, and in such a way that the first wall is formed underneath the insertion of the branch; the next wall, dividing the large cell, is formed opposite to it, the segment by these divisions being divided into three cells, a larger cell in the middle and two smaller peripheral ones on both sides. Then finally the cell in the middle is divided by two walls in a central and two opposite peripheral cells. It is a well known fact that this plant has previously been included among the *Rhodomelaceæ**), but the above-described way of cell-division is quite in concord with that found in the *Delesseriaceæ* and differing from that in the *Rhodomelaceæ*. Compare in this connection the schematic figures of both kinds of division given by FALKENBERG, l. c., p. 4. The main stem in the upward growing branches is terete like that of the prostrate main axis. The branches carry mostly 3—4 branchlets; but now and then in more weakly developed plants the erect branches are reduced to a single branchlet.

The final shape of the branchlets is flat.

The lowest segments of the branchlets remain terete: but in the following segments the two opposite peripheral cells become divided in such a way that first a smaller cell is cut off in the upper peripheric corner by a convex wall and then a similar cell is cut off in the corner below (cp. Fig. 337 *b*). No further divisions do take place. This division of the cells is quite in agreement with that found in other *Delesseriaceæ*.

The branchlets are not ramified until a side-branch is formed at rather definite distance from their base (about 15 segments).

The apical cell of this one gets the same or nearly the same strength and the same direction as that of the mother-axis. Both

*) Compare FALKENBERG, l. c., p. 708.

cells are divided in a similar way giving origin to the two long hair-like filaments crowning the branchlets (Fig. 337*b*). At the base of the hairs short segments are cut off; these grow longer upwards, become hair-like without chromatophores, the uppermost ends of the hairs dying away gradually. It cannot be denied that these terminally placed hairs bear a close resemblance to those of the *Phæosporaceæ* having a very similar intercalary division. The growing point lies a little above the bifurcation, the segments being shortest here and always filled densely with protoplasma etc.

My specimens are all sterile. The stichidia are beautifully figured by THURET, l. c. The sporangia are formed in two rows in the flat branchlets in the remaining part of the two pericentral cells from which the two border-cells are cut off.

The cystocarps are unknown. COLLINS and HERVEY*) mention that they have found a mature cystocarp, but it was lost before notes and figures could be made.

The plant was found in an open place upon reefs of calcareous algæ etc. with shallow water or nearly laid dry.

St. Jan: Cruz Bay.

Geogr. Distrib.: Pacific Ocean, West Indies, Cape, Morocco, Mediterranean Sea, Tongatabou. Seems to be widely spread in warmer seas.

Caloglossa J. Ag.

1. Caloglossa Leprieurii (Mont.) J. Ag.

AGARDH, J., Epicrisis, p. 499. CRAMER, C., Über *Caloglossa Leprieurii* (Mont., Harv.) J. Ag. in Festschrift f. NÄGELI u. KÖLLIKER, Zürich 1891.

Delesseria Leprieurii Mont. Seconde Centurie de plantes cell. exotiq. nouvelles in Ann. Sc. Nat., Bot., II. sér., t. 13, p. 196, pl. 5, fig. 1. J. AGARDH, Spec. Alg., vol. II, p. 682. HARVEY, W. H., Nereis Bor.-Am., Part II, p. 98, pl. XXII. C.

Hypoglossum Leprieurii Kütz., Spec. Alg., p. 875; Tab. phycolog., vol. XVI, tab. 10. NÄGELI, C., Wachsthumsgeschichte von *Hypoglossum Leprieurii* (Mont.) Kg. in NÄGELI und C. CRAMER, Pflanzenphys. Untersuch., 1. Heft. 1855, p. 69, tab. VIII.

This species has been examined several times, especially by NÄGELI and CRAMER, to whose beautifully illustrated examinations I here refer.

Caloglossa Leprieurii (Fig. 338) is one of the algæ commonly occurring on the roots of the mangroves, upon which it often forms

*) COLLINS, F. S. and A. HERVEY. Algæ of Bermuda, p. 117.

dense tufts. Its flat, leaflike thallus is thin, consisting, with the exception of the midrib, of only a single layer of cells; it is repeatedly forked and narrowed at each ramification, the internodes, on account of this narrowing, being lanceolate. One of the flat sides of the thallus is turned upwards, the other downwards against the substratum. From the side turned down rhizoids are issued at the forkings of the thallus (Fig. 338). Small epidermal cells are cut off from a group of central cells at the forkings, cp. NÄGELI, 1855, l. c., p. 73, pl. VIII, figs. 1 and 7. From these cells a bundle of rhizoids grow

Fig. 338. *Caloglossa Leprieurii* (Mont.) J. Ag.
Part of a plant. (About 6:1).

out, cohering more or less at their outgrowth, later on separating and spreading out in all directions. By means of these haptera the plant is fixed to the substratum.

I have not come across tetrasporangia in my material, but tetrasporic plants and the structure of the tetrasporangia have been described by CRAMER, l. c. The tetrasporangia are formed in great number in a single layer in the tissue on both sides of the midrib. In the part of the thallus destined to produce the tetrasporangia the cell-division takes place in a way somewhat differing from that in the vegetative thallus. The primary marginal cells form only a single row of cells; these cells are later divided into two cells: one above, namely the mother cell of the tetrasporangia, and one below

which remains vegetative. Gradually, as the tetrasporangium increases in size, the last mentioned cell becomes slender and curved round the tetrasporangia; it gets a semilunar shape and its upper end becomes connected with the cell above. In this way a reticular tissue of vegetative cells is formed connecting the midrib with the not fructiferous marginal cells of the thallus.

The antheridial stands have previously been found by CRAMER. I have come across a few male plants in my material. When CRAMER remarks that he has found the antheridial stands upon "kleinen Ceylonpflänzchen", my plants were by no means especially diminutive, on the contrary the thallus of the male plant was even larger than that of the female, at any case broader. In the male plant the breadth of the thallus was two mm, in the female only about 1½ mm.

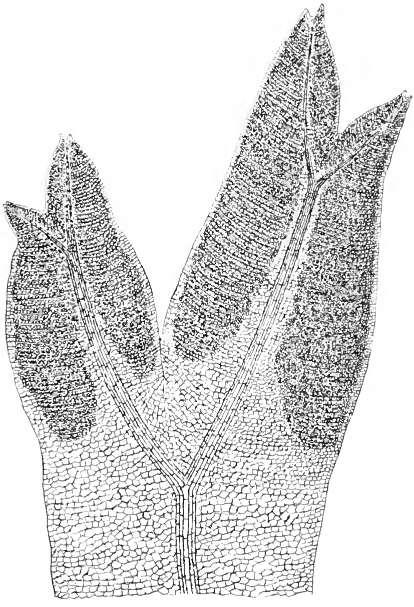


Fig. 339. *Caloglossa Leprieurii* (Mont.) J. Ag. Part of a male plant with antheridial stands. (About 30:1).

The antheridial stands (Fig. 339) occur in the upper parts of the thallus as large coverings upon both sides of the thallus leaving the midrib free and mostly, too, a narrow belt of vegetative cells along the edge of the thallus. The cell-division in the male plant takes place in nearly the same way as that in the vegetative one, only the cells forming the tissue being smaller. From the surface of these cells about 2—4 small cells originate from which the spermatia are cut off.

As to the cystocarps I have only found a few. As described by

CRAMER, they occur upon the midrib of the thallus. They are spherical of shape about 460 μ broad. CRAMER maintains that the cystocarps occur upon the underside of the thallus. This I have not been able to verify in my material, the small pieces found with cystocarps being without rhizoids.

As mentioned above this species occurs upon the roots of the mangroves under whose shade it is able to grow, even somewhat above the surface of the sea. Like several *Bostrychia*-species it often lives, too, in brackish and dirty water. According to HARVEY it is even found in rivers in Georgia and Florida and M. A. HOWE*) came across this plant in a mountain stream in Porto Rico. The locality was about 12 kilometers from the sea and the elevation about 400 to 500 meters. ZANARDINI, GOEBEL and KARSTEN have described related species from Borneo, Zanzibar and the island of Amboina all living in fresh water.

This species has been found at St. Croix: Christianssted's Lagoon, Salt River Lagoon.

Geogr. Distrib.: Seems to be widely distributed in warmer seas.

Subfam. 2. Delesserieæ.

Delesseria Lamour.

1. Delesseria tenuifolia Harv.

HARVEY, W. H., Nereis Bor.-Am., II, p. 97, pl. XXII, B. KÜTZING, F., Tab. Phycol., vol. XIX, tab. 13, figs. d, e, f. AGARDH, J., Epicrisis, p. 488.
Hypoglossum tenuifolium J. AGARDH, Spec. Alg., vol. 3, pars 3, 1898, p. 186. BØRGESEN, F., Some new or little known West Indian Florideæ, II, p. 198.

This fine, delicate plant (Fig. 340) forms dense bushes up to ten cm or even more. When alive it mostly had a bright yellow-greenish colour, but when dried it got a reddish tinge. It has a shorter or longer basal stem up to 1 cm long, from which the densely ramified often nearly globular, thallus arises. The stem consists of the first developed leaf of the young plant, whose cells have grown large with thick walls, but this has further been strengthened by means of a parenchymatous tissue, forming on both sides of it a semicircular tissue (cp. Fig. 341 *a*).

*) HOWE, M. A., *Caloglossa Leprieurii* in mountain streams (Torreya, vol. 2, 1902, p. 149).

At the base the stem produces irregular bundles of rhizoids, which gradually separate, fixing themselves to stones, shells, coralline algæ etc.

The single leaf of the thallus is linear-lanceolate of shape with an obtuse, generally emarginate apex. It consists of only a single layer of cells, with the exception of the midrib in which three layers are found (Fig. 342 *C*), namely a smaller, nearly quadratic central cell and two larger, peripheric cells. From this midrib proliferous young leaves are repeatedly issued (Fig. 340), the ramification of the thallus being formed in this way.

In the older part of the thallus the midrib and nearest surrounding cells of the leaf become strengthened by rhizoids growing out from the basal cells of the proliferous leaves. Gradually in approaching the base these rhizoids form a parenchymatous tissue which becomes thicker and thicker until it, as mentioned above, becomes in strong plants nearly semiglobular in the basal stem (Fig. 341 *a*).

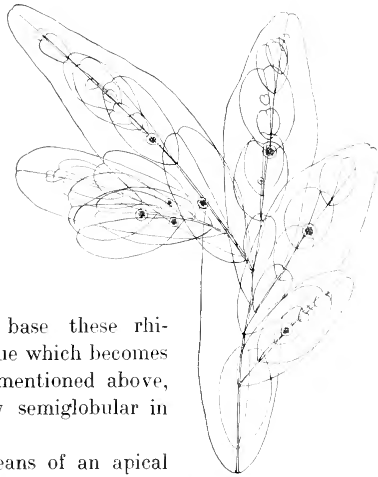


Fig. 340. *Delesseria tenuifolia* Harv. Part of a female plant with crystocarps. (About 4:1).

The thallus increases by means of an apical cell from which semicircular segments are cut off (Fig. 341 *b*). The segments are divided in a central and two marginal cells. It is a well known fact, mentioned already by NÄGELI and SCHWENDENER*), that the thallus of the *Delesseriaceæ* is built up by means of filaments congenitally connate. From the central axis opposite, biseriate filaments are issuing. These filaments are unilaterally ramified, the branchlets issuing from their underside. In our plant, cp. Fig. 341 *b*, the first side-branch is usually issuing from the large cells on both side of the midrib and, sometimes, from one of the following cells in the filaments still one more side-branch is given off in other filaments the branching first takes place from the

*) Das Mikroskop, 2te Aufl. 1877, p. 561.

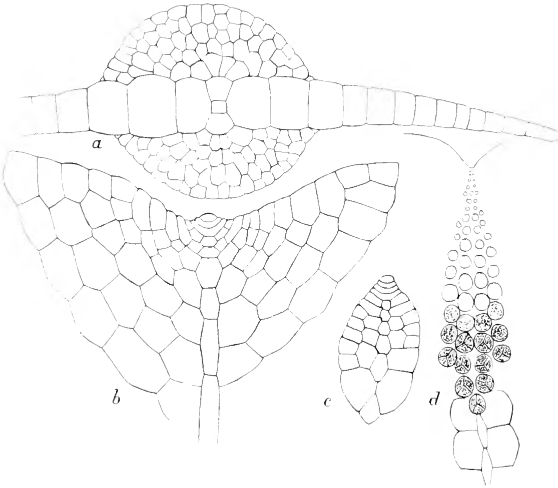


Fig. 341. *Delesseria tenuifolia* Harv.
a, transverse section of older leaf. *b*, summit of a leaf. *c*, a young leaf. *d*, middle part of the leaf of tetrasporic plant. (*a*, about 45:1. *b*, 270:1. *c*, 250:1. *d*, 120:1).

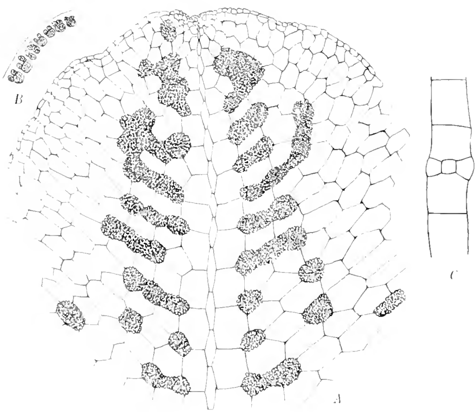


Fig. 342. *Delesseria tenuifolia* Harv.
A, part of the leaf of an antheridial plant (120:1). *B*, transverse section of antheridial stand (270:1). *C*, transverse section of the midrib of the leaf (120:1).

second or third cell in the filaments, and filaments occur which are not branched at all. NIENBURG*), in his paper on the construction of the thallus of the *Delesseriaceæ*, has pointed out (l. c., p. 205, 6, figs. 43, 44) that we have two principal ways of ramification in this family. Of these our plant agrees with the *Hypoglossum*-type as found in *Delesseria Hypoglossum*.

As I have already mentioned in my paper quoted above, tetrasporic as well as antheridial and cystocarpic plants were found in my collection.

The tetrasporangia (Fig. 341 *d*) occur close to the midrib, symmetrically arranged on both sides of it. Their development begins at about the middle of the leaf and continues upwards, the tetrasporangia being younger and younger towards the summit.

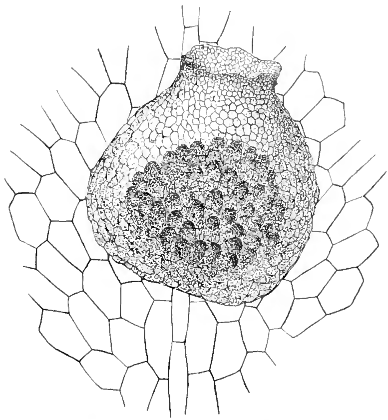


Fig. 343. *Delesseria tenuifolia* Harv. A nearly ripe cystocarp. (About 80:1).

The antheridial stands (Fig. 342 *A*) are placed on both sides of the midrib of the leaf forming low, dense cushions. They are arranged rather regularly, generally following the main filament in each of the branch-systems of which the leaf consists, leaving in this way the side-branch bare, but it happens that some of the cells in these, too, are covered with antheridia, some larger tufts being formed in this way. The arrangement of the antheridial stands bears rather a close resemblance to that found in *Delesseria ruscifolia*, cp. BUFFHAM**). The cystocarps (Fig. 343) are urn-shaped and issuing from the midrib of the leaf.

*) NIENBURG, W., Zur Keimungs- und Wachstumsgeschichte der Delesseriaceen. (Botanische Zeitung, 1908).

**) BUFFHAM, P. H., On the antheridia, etc. of some Florideæ (Journal of the Quekett microscop. Club., vol. V, ser. II, 1893, p. 6, pl. LXIV, fig. 25).

This plant was found with tetraspores, antheridia and cystocarps in the month of March.

It was dredged in deep water about 30—40 meters and in a place where strong currents prevail.

St. Jan: In the sound between this island and St. Thomas: off Cruz Bay.

Geogr. Distrib.: Florida.

Subfam. 3. **Nitophylleæ.**

Martensia Hering.

1. **Martensia Pavonia J. Ag.**

J. Agardh, Spec. Alg., vol. II, p. III, p. 831. Kützing, F., Tabulæ Phycol., vol. XIX, tab. 60, figs. e—n. Svedelius, N., Über den Bau und die Entwicklung der Florideengattung Martensia (K. Sv. Vetenskapsakad. Handl., Band 43, No. 7. Uppsala 1908).

Mesotrema Pavonia J. Ag., Nya algformer in Öfvers. k. Vetensk.-Akad. Förhandl., 1854, p. 110.

Svedelius in his very valuable work on the genus *Martensia* gives an exhaustive description of the present species based partly upon material collected by me at the island of St. Croix.

Having now examined some more collections of mine of this plant I am able to add a few remarks to Svedelius' description.

Martensia Pavonia grows epiphythic upon other algæ between whose filaments it becomes entangled, furthermore fixing itself by means of rhizoids which seem to be able to grow out nearly everywhere from the margin of the thallus (Fig. 344). The rhizoids issue not only from the coherent tissue, but also from the reticular part of the thallus (cp. the figures of Svedelius, l. c., p.34, fig. 34). A supposition expressed by Svedelius and one to which I am quite willing to subscribe is that parts of the plant torn loose or such ones becoming free by the decomposition or dying away of the net are able just by means of these rhizoids to fix themselves and give rise to new plants.

Martensia Pavonia (Fig. 345) together with the Australian *Martensia denticulata* form a small, distinguished group within the genus *Martensia*, both species being by J. Agardh referred to his subgenus *Mesotrema*. What especially characterizes this group is the belts of coherent tissue and reticular tissue successively following

each other while in the other species of *Martensia* this arrangement is not found at all or at any rate only slightly indicated.

According to SVEDELIUS the coherent tissue of the young frond is formed by filaments congenitally connate just as in the case of the other *Delesseriaceæ*. Later on intercalary cell-divisions contribute to the growth of the tissue. When the coherent tissue has reached a certain breadth the development of the net begins. Some large cells, becoming the basal ones of the net, are formed along the margin and from each of these a row of cells grow up; these cell rows are mutually free with the exception of the uppermost cells of the rows which at both sides all are connected together with those of the neighbour cell-rows. From these connected cells the next belt of coherent tissue originates (comp. Fig. 345). The free rows of cells are running nearly parallel to each other; their cells are soon divided by horizontal walls (lying in the plane of the thallus), the cell-rows herewith being transformed into lamellæ. In this way the longitudinal beams of the net are formed. About the same time when division of the cells takes place in the longitudinal rows of cells the cross-beams of the net begin to grow out. In *Martensia Pavonia* these are formed in such a way that a cell in the longitudinal cell-row grows out unilaterally in the direction of the neighbour cell-row (comp. the fig. 33 of SVEDELIUS). This outgrowth, being separated from the mother cell by a wall, soon reaches the opposite cell-row and then grows together with it in a way very similar to that found e. g. in *Dictyurus*, *Microdictyon* etc. In forming the cross-beams in this way *Martensia Pavonia* differs for instance from *Martensia fragilis* in which two outgrowths issue oppositely from each cell; these outgrowths meet those issued from the neighbour cell-rows half-way and grow together conjointly.

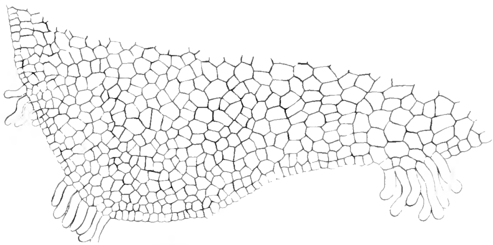


Fig. 344. *Martensia Pavonia* J. Ag.
Part of the coherent tissue with groups of rhizoids issued from the margin.
(About 80 : 1).

Svedelius maintains that the cross-beams are given off rather regularly at nearly the same height, but this holds good only with regard to the young tissue; later on in the older tissue so many new cross-beams are formed at various distance and height that their distribution is quite irregular. Sometimes, but not always the cells of the cross-beams in the older net are divided so that these consist of a few layers of cells just as in the case of *Martensia fragilis.*

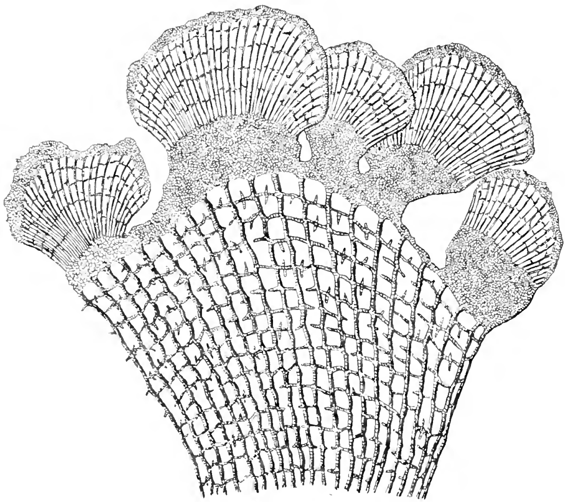


Fig. 345. *Martensia Pavonia* J. Ag.
Part of the thallus.
(About 10:1).

Finally in the older net secondary longitudinal beams are formed running nearly parallel to the original longitudinal lamellæ. As a rule they protrude themselves freely (cp. Figs. 345, 346), but it may happen that they reach another similar cell-row and grow together with it. These secondary longitudinal cell-rows were not found in the material examined by Svedelius, but Svedelius asserts that they are found in *Martensia flagelliformis* with which species *Martensia Pavonia* therefore agrees in this respect.

Tetrasporangia did not occur in the specimens examined by Svedelius. They (Fig. 346) are formed in the older net, but I have also

found them a few times in the coherent tissue. They occur in small sori; later on these sori often merge into smaller groups. When they are found in the coherent tissue the sori, too, merge into rather large groups. When the tetrasporangia are ripe they become free through holes formed by the bursting of the covering cells; the net gradually dies away and is dissolved. In this way the coherent part of thallus becomes free and is able to give rise to new plants as mentioned above.

SVEDELIUS has found male plants in the material examined by him. The antheridial stands occur upon the sides of the lamella in the net as roundish, mostly definite sori (compare SVEDELIUS, l. c., p. 66, fig. 49); sometimes it happens that some of the antheridial groups become connected through the fertilization of the tissue between them.

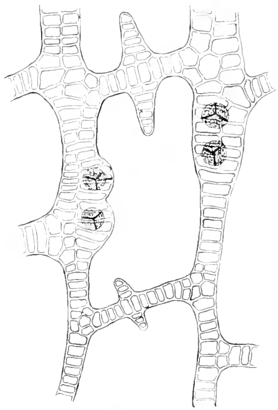


Fig. 346. *Martensia Pavonia* J. Ag. Part of the net with tetrasporangia. (About 70:1).

I have not found cystocarpic plants. When the plant grows in shallow water it is rather robust, the thallus is broad and proportionally short. Sometimes it covers smaller algæ e. g. *Hypnea*, quite densely, forming together with these, roundish tufts.

In specimens from deep water on the other hand the thallus is thin, elongated and narrow. The meshes in the net are large. The lamellæ are thin, and proportionally few cross-beams are found. Secondary longitudinal lamellæ were also found in some of the deep water specimens.

This species was found in shallow water in somewhat sheltered localities and in deep water in the more open sea down to a depth of about 30 meters. It had tetrasporangia and antheridial stands in the months January—March.

St. Croix: Lt. Princess, here often washed ashore; near Buck Island (about 10 meters). St. Jan: In the sound between this island and St. Thomas in several places.

Geogr. Distrib.: West Indies.

Fam. 4. Bonnemaisoniaceæ.

Asparagopsis Mont.

1. Asparagopsis taxiformis (Delile) Collins et Hervey.

COLLINS and HERVEY, Alg. Bermuda, p. 117.

Asparagopsis Delilei Mont. in BARKER-WEBB et BERTHELOT, Hist. nat. Iles Canaries, t. 3, part. 2, sectio 4. 1840, Addenda, p. XIV. J. AGARDH, Spec. Alg. vol. II, p. III, p. 776; Epicrisis, p. 666. KÜTZING, F., Spec. Alg., p. 802; Tab. phycologicæ, vol. XIV, tab. 92. ASKENASY, E., Forschungsreise Gazelle, IV Theil, Bot., p. 40, Taf. IX, fig. 9, 10.

Dasya Delilei Mont., in WEBB et BERTHELOT, Hist. nat. Iles Canaries, t. 3, part 2, sect. 4, p. 166, 7. pl. VIII, fig. 6.

Fucus taxiformis Delile, Flore d'Égypte, p. 151, pl. 57, fig. 2. C. AGARDH, Spec. Alg., p. 368.

Lictoria taxiformis J. Ag., In historiam Alg. Symbol. in Linnæa. vol. XV, 1841, p. 23.

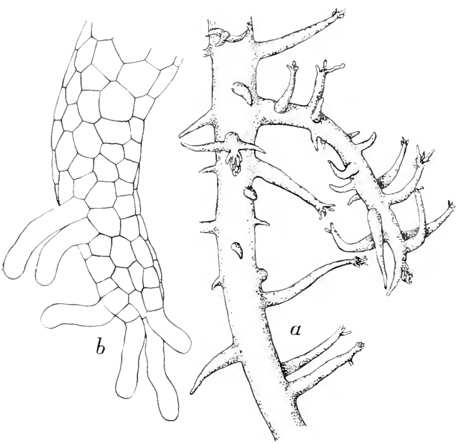


Fig. 347. *Asparagopsis taxiformis* (Delile) Collins et Harvey.
a, part of the creeping basal stems with numerous branchlets and rhizoids in their summits; upon the upwards turned side of the stem young erect shoots. *b*, end of a branchlet with rhizoids. (*a*, about 25:1, *b*, 175:1).

I quite agree with COLLINS and HERVEY that the original specific name of this plant ought to be adopted because MONTAGNE, l. c. p. 166, only honoris causa, replaced the specific name given it by DELILE and called it *A. Delilei*.

The plant grows in tufts formed of creeping rhizome-like terete stems from which the beautiful ostrich-feather-like erect shoots arise.

The creeping stems (Fig. 347 *a*) are very irregularly ramified. The branches consist of two kinds, either branches with continuous growth or branchlets with definite growth and without ramification. The branches grow out either to decumbent, creeping branches, contributing in this way towards the ramification of the basal part, or

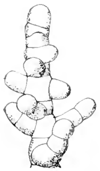


Fig. 348. *Asparagopsis taxiformis* (Delile) Collins et Hervey. Summit of the thallus. (About 250:1).

they bend upwards becoming erect shoots. The branchlets are vigorously developed, conical in shape with a broad base and a more or less acute summit (cp. Fig. 347). They fix the plant to the substratum through numerous recurved rhizoids breaking out from their summits. These rhizoids are often rather long, cylindrical, with transverse walls, and attach themselves to the substratum: stones, shells, calcareous algæ etc.

The erect shoots reach a height of about 20 cm. They are barren in their basal part; richly pinnately ramified in the upper part.

The thallus increases by means of an apical cell from which segments are cut off by oblique walls in various directions (Fig. 348). From these segments the central cells originate and the peripheral cells, too, which through numerous divisions are divided into the epidermal parenchymatic tissue.

The branches grow out at an early stage even before the segments are divided. They begin as small roundish outgrowths from the segments, two from each. Of these outgrowths the largest one issues at the broadest side of the oblique segment appearing earlier than the other, smaller one, and this different stage of vigour and size of each pair of branches is kept and clearly seen later on also in the older parts of the plant. Furthermore, besides this different development, the two branches of each pair are not placed exactly opposite to each other, but a little obliquely (cp. Figs. 348, 349*a*).

In the fully developed thallus

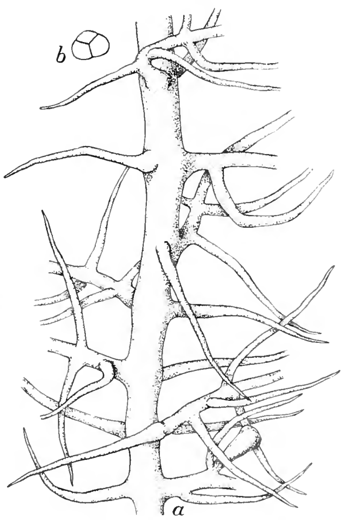


Fig. 349. *Asparagopsis taxiformis* (Delile) Collins et Hervey. *a*, part of a branch showing the ramification, the lowest branchlets to the right with a young cystocarp. *b*, transverse section of a thin branchlet. (*a*, about 25:1; *b*, 80:1).

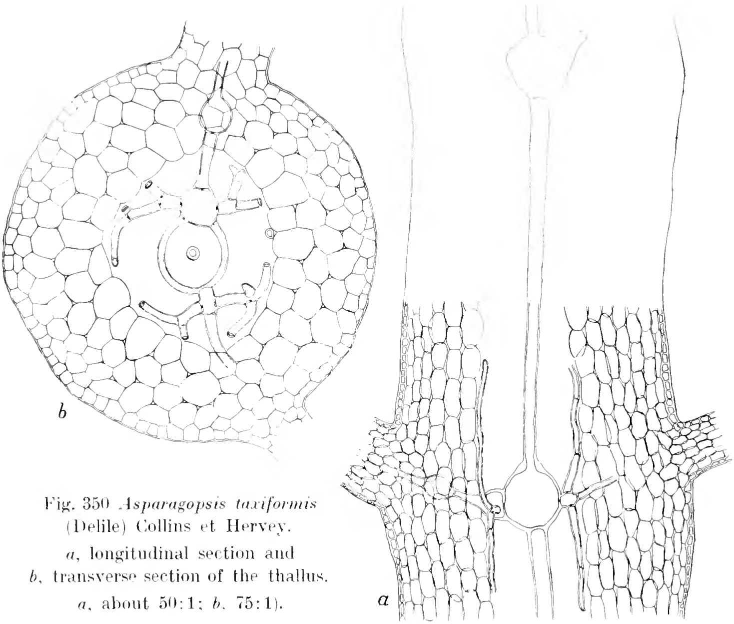


Fig. 350 *Asparagopsis taxiformis* (Delile) Collins et Hervey. *a*, longitudinal section and *b*, transverse section of the thallus. *a*, about 50:1; *b*, 75:1).

this form of ramification takes place several times, the branches of each higher order becoming only shorter and less vigorously developed. Fig. 349 *a* gives a representation of the ramification. A part of a branch-system of a somewhat higher order is here figured in which the most vigorous branches of each pair are ramified only, while the others are unbranched; and the side-branches of the ramified branches are all unbranched. The result of this ramification is, that the fully developed thallus gets a beautiful featherlike appearance.

The thin branchlets consist of three rows of cells without any central cell (Fig. 349 *b*), the cells being alternately arranged (cp. Fig. 351 *A*). On the other hand the thicker branches and the main branches have a well developed central axis of a rather peculiar appearance.

Askenasy has given a short description of the anatomical con-

struction of the stem, but as this is rather brief. I shall give a further description together with some figures.

Upon a transverse section of the main stem in the neighbourhood of the place where the pair of branches issue we find an arrangement like that shown in Fig. 350 *b*. The central cell is here very large, its diameter reaching a length of about 180 μ. It is surrounded by a circular open space filled with sap, round which again follows the rather thick, parenchymatous, peripheral tissue. On both sides of the central cell, but not exactly opposite, two filaments issue. One of these filaments is thicker and more vigorous than the other and both extend themselves in the branches given off here the more vigorous in the thickest, the other in the thinnest of the two branches. From the first cell of these ramifications, the one nearest to the central cell, thin hyphæ-like filaments issue in all directions, the cells in this way becoming stellately ramified. These thin filaments run up and down in the space within the interior wall of the peripheral tissue; they are rather irregularly, often subdichotomically, ramified. The peripheral tissue itself consists of 5—6 layers of cells of roundish shape, largest in the interior, decreasing gradually towards the periphery.

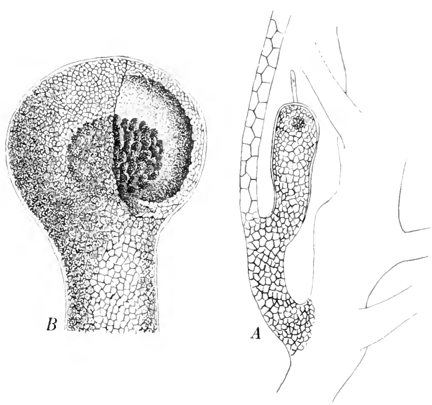


Fig. 351. *Asparagopsis taxiformis* (Delile) Collins et Hervey.
A, part of a branch with procarp. (25:1); *B*, cystocarp (about 8:1).

A longitudinal section (Fig. 350 *a*) shows that the central axis consists of very long cells about 1500 μ long, being in the upper part cylindrical (about 45 μ thick) and in their lowest part much swollen, nearly globular. It is from this globular part that the branches issue.

Of this plant only female ones were gathered. The procarps occurred at the tip of short clavate branchlets (Fig. 351 *A*) growing

out at the base of the pinnate side-branches. A single almost ripe cystocarp was found (351*B*); it was nearly spherical, placed terminally upon a short, thick branch. My plants were gathered in March; M[lle] VICKERS has had plants with cystocarps from Barbadoes collected in July.

Antheridial stands have been described by ASKENASY, l. c.; according to him the antheridia cover more or less completely the summit of short clavate branchlets.

This plant has been dredged a few times in deep water only, at a depth of about 12 fathoms. It was growing in a place where strong currents prevail and was gathered with young cystocarps in the month of March.

St. Jan: In the sound between this island and St. Thomas off Cruz Bay.

Geogr. Distrib.: West Indies, Canary Isles, Mediterranean Sea, Pacific Ocean.

IV. Gigartinales.

Fam. 1. ***Gigartinaceæ.***

Subfam. 1. Gigartineæ.

Gigartina Stackh.

1. **Gigartina acicularis** (Wulf.) Lamour.

LAMOUROUX, Essai des Thalassiophytes, 1813, p. 48. AGARDH, J., Spec. Alg., vol. II, p. 263; Epicr., p. 190. KÜTZING, Spec. Alg., p. 749; Tab. Phycol., vol. 18, tab. 1. HARVEY, W. H., Phycol. Brit., tab. 104.

Fucus acicularis Wulf., Cryptogama aquatica, p. 63, No. 50. TURNER, Fuci, tab. 126.

For more synonyms compare DE-TONI, Sylloge Alg., vol. IV, sect. I, p. 198.

This species has only been gathered once in shallow water and in a sheltered place. The few specimens found were sterile.

St. Croix: The harbour of Christianssted.

Geogr. Distrib.: Seems to occur in all warmer seas.

Subfam. 2. Tylocarpeæ.

Gymnogongrus Mart.

1. Gymnogongrus tenuis J. Ag.

J. Agardh, in Act. Holm., 1849, p. 88; Spec. Alg., vol. II, p. 319; Epicr., p. 211.

Chondrus tenuis J. Ag. in Kützing, Spec. Alg., p. 736; Kützing, Tab. Phycol., vol. 17, pl. 52.

The specimens form dense bushes upto 5—6 cms height. The thallus is of a firm and cartilaginous consistency; it is flat and repeatedly forked (Fig. 352).

From a transverse section of the thallus it appears that it consists of a parenchymatic tissue, whose cells are largest in the middle (about 40—50 μ lat.) smaller outwards. The cortical layer consists of small cells with thick walls placed in rows forming together a very firm tissue. It is surrounded by a rather thick cuticle.

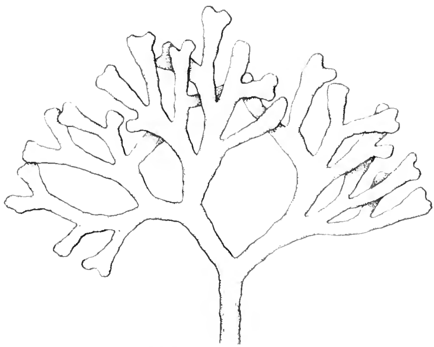


Fig. 352. *Gymnogongrus tenuis* J. Ag. Part of the thallus. (About 2/1).

In some of the specimens, collected in March, cystocarps were found forming proportionately large, flat, roundish-oval projecting discs on the one side of the thallus.

The plant is a littoral alga. It was growing on stone-quays etc. together with *Grateloupia*, *Ulva* etc. near the surface of the sea in places where the waves constantly dash the stones and where the water was much polluted.

St. Thomas: The harbour of Charlotte Amalia.

Geogr. Distrib.: West Indies, Mexico, La Guayra.

Subfam. 3. Kallymenieæ.

Kallymenia J. Ag.

1. Kallymenia perforata J. Ag.

J. AGARDH, Bidrag till Florideernes Systematik, p. 9; Epicrisis, p. 219.
BØRGESEN, F., Some new or little known West Indian Florideæ, II, p. 180.

A few specimens of this plant, first described from Ceylon, were dredged in the sea around St. Jan. As mentioned in my paper quoted above I have been able, through the kindness of Prof. SVEDELIUS in Upsala, to compare my plant with an authentic specimen from Ceylon. From this comparison I arrived at the conclusion that both plants, as to their outer habit and anatomical structure, seem to agree perfectly.

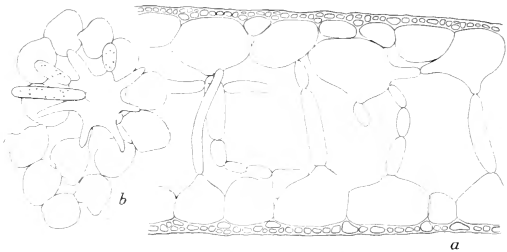


Fig. 353. *Kallymenia perforata* J. Ag.
a, transverse section of the thallus. *b*, a stellate cell.
(About 150:1).

The plant has an *Ulva*-like, flat thallus, perforated by numerous roundish holes, smaller in the young thallus, larger in the older, this receiving thereby a reticular appearance. The holes seem to originate through the tissue in certain places becoming absorbed. At any rate I have several times in younger parts of the thallus found small, roundish, rather well-marked spots in which the tissue was much thinner than in the other part of the thallus, these thinner parts being undoubtedly the beginning of the holes.

A transverse section of the thallus (cp. Fig. 353 *a*) shows that this consists on both sides of a rather loose and thin-walled cell-tissue and of a cavity in the middle through which filaments are running in all directions.

At the surface on both sides of the flat thallus we find a cortical layer composed af small roundish cells of somewhat variable size. Below this tissue a layer of large cells follows. These cells are of rather variable shape, often with long prolongations. The innermost cells facing the cavity in the interior of the thallus, have often several prolongations becoming more or less regularly stellate of shape (Fig. 353*b*). From these cells longer nearly cylindrical cells or shorter oval ones forming shorter or longer chains issue connecting the cell-layers of both sides.

How far this plant is rightly referred to the genus *Kallymenia* seems to me rather problematic. Its anatomical structure, at any rate, is not much like that found in the Fam. *Gigartinaceæ*, and it shows much more likeness to that occurring in forms belonging to the *Rhodymeniaceæ*, e. g. *Chrysymenia*, to the flat forms of which it bears a close resemblance. Nevertheless until fructiferous organs are found I think it preferable to let it remain in the genus *Kallymenia* which according to Schmitz (in Engler u. Prantl, Nat. Pflanzenfam. Teil 1, Abt. 2, 1897, p. 365) contains forms most probably belonging to several different genera.

The specimens were all sterile; they were dredged only in deep water (about 30 meters) in places where strong currents prevail and found attached to other algæ, stones etc.

St. Jan. In the sound between this island and St. Thomas near Gr. St. James, and near Maria Bluff, Whistling Cay.

Geogr. Distrib.: Ceylon, West Indies.

Fam. 2. Rhodophyllidaceæ.

Subfam. 2. Cystoclonieæ.

Catenella Grev.

1. Catenella Opuntia (G. et W.) Grev.

Greville, R. K., Algæ Britannicæ, 1830, p. 166. pl. 17. Harvey, Manual, p. 51; Phycologia Britannica, pl. 88. Agardh, J., Spec. Alg., vol. II, p. 352; Epicrisis, p. 588.

Fucus Opuntia Good. et Woodw., Observations on the Brit. Fuci in Linn. Trans. III, p. 219. Stackhouse, J., Nereis Brit., p. 42. Turner, Fuci, pl. 107.

Catenella pinnata Harv., Nereis Bor.-Am., p. 201, pl. 29 *B*.

This small plant was found a few times in lagoons growing upon the roots of the mangroves to which it fixes itself by means of haptera

(Fig. 354). These are, as a rule, developed from the narrowings of the thallus and consist of a short stalk ending in a broad disc. As the specific name indicates the shape of the thallus reminds one very much of that of *Opuntia*, being rather regularly narrowed and again enlarged, giving it a resemblance to a chain whose single joints are elongated elliptic. From the thickest part of the joints, which is

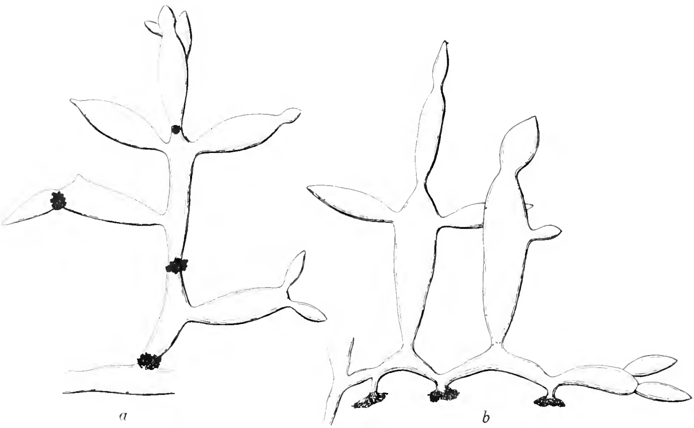


Fig. 354. *Catenella Opuntia* (G. et W.) Grev. Parts of plants. *a*, from below; *b*, from the side. (About 6:1).

found frequently somewhat above the middle of the joint, one or commonly two opposite side-branches grow out, these sometimes being erect, and sometimes bending downwards in different directions and fixed by haptera to the mangrove roots. By this way of growing a felted cover about 2 cms high is produced round the roots.

From transverse and longitudinal sections of the thallus (comp. (Okamura, Icones, vol.1, pl. 39) it appears that the tissue in the middle consists of several thick-walled filaments running the length of the plant and composed of rather long, cylindrical cells. From these cells thin filaments are given off in all directions towards the periphery, being bi-or tripartited several times, forming a very lacunose tissue. Near the periphery the filaments are much ramified, their cells becoming smaller and densely packed, forming in this way a firm cortical layer.

All my specimens were sterile. Upon the whole this plant seems seldom to fruit, at any rate it is seldom found in a fruiting condition. Harvey Gibson has given a description of fertile plants. Referring for more detail to his paper*) I shall only mention here that according to him the tetraspores are formed in the cortical layer. They have zonate division.

The antheridia and cystocarps occur often upon the same plant. The antheridial stands consist of numerous small groups immersed in the cortical tissue, and they are found upon small wrinkled ramuli (compare also Buffham**).

The cystocarps are nearly spherical bodies with a short stalk placed upon the erect branches, every articulation bearing one or two of these small cystocarpic branchlets. I shall not here enter into a more detailed description of the development and very peculiar construction of the cystocarp, but only mention that the carpospores are formed in great numbers in the interior and that the spores seem to get free by rupture of the cortical layer as no carpostome is found.

This is a littoral alga found at the islands in sheltered places only. Growing as it does in the shade of the mangroves it is able to grow even a little above the surface of the sea.

It does not seem to be common at the islands. St. Croix: Christianssteds Lagoon; Saltriver Lagoon. St. Thomas: Bovoni Lagoon.

Geogr. Distrib.: Seems to occur in nearly all warmer seas.

Agardhiella Schmitz.

1. **Agardhiella tenera** (J. Ag.) Schmitz.

Schmitz, Fr., System. Uebers. Gatt. Florideen (Flora, 1889, vol. 72, p. 435); in Engler u. Prantl, Nat. Pflanzenf., Teil I, Abt. 2, p. 371.

Rhabdonia tenera J. Ag., Spec. Alg., p. 354; Epicrisis, p. 592. Osterhout, On the life-history of *Rhabdonia tenera* J. Ag. (Annals of Bot., vol. X, 1896).

Solieria chordalis Harv., Nereis Bor.-Am., vol. II, p. 121, tab. 23 A.

Rhabdonia Baileyi Harv. in Kützing, Tab. Phycol., vol. XVI, p. 26, pl. 74 *c*, *d*.

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*) Harvey, Gibson, R. J., On the structure and development of the cystocarps of *Catenella Opuntia* Grev. (Journ. Linn. Soc., Bot., vol. XXIX. London 1893).

**) Buffham, T. H., On the reproductive organs, especially the antheridia, of some of the Florideæ (Journal of the Quekett microscop. Club, vol. III, Ser. II, p. 5, pl. 21. figs. 10—11).

The life-history of this plant has been studied very minutely by OSTERHOUT. The following short description is based partly upon his description, partly upon my own observations.

Agardhiella grows at the islands in more sheltered places in shallow water and likes localities with sandy or muddy bottom sprinkled with stones. To these the plant is fastened by means of a disc from which often several erect stems arise. These are much branched

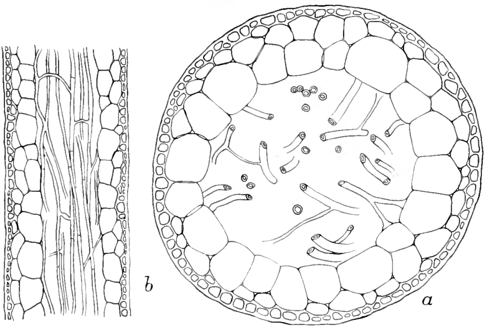

Fig. 355. *Agardhiella tenera* (J. Ag.) Schmitz.
a, transverse section of the thallus. *b*, longitudinal section of the thallus.
(*a*, about 80:1; *b*, 45;1).

in all directions, the plant forming in this way small highly branched bushes up to about a foot high. When growing in shaded places their colour is a clear rosy-red, in strong light on the other hand they assume a more yellowish-brown tinge.

The summit of the plant looks like several densely placed filaments. According to OSTERHOUT's examination and as far as I have seen there is nevertheless a central filament and lateral filaments extending from it.

Transverse and longitudinal sections of the thallus (Fig. 355) show that there is in the middle a very loose tissue consisting of long much curved and bent filaments, now and then ramified and running between each other. In the fully developed thallus this medullary tissue is so loose that we may rightly say that there is, in the interior of the thallus, a cylindrical cavity filled with sap through which the filaments run. The peripheral tissue is firmer, consisting innermost of one or two layers of large, roundish-polygonal cells covered by a layer of small epidermal cells.

The tetrasporangia, antheridia and cystocarps are found upon separate plants.

The tetrasporangia are developed in the peripheral tissue. The mother-cells of the sporangia become enlarged, filled with protoplasma and getting a dark red colour. They are zonately divided.

The antheridial stands occur everywhere upon the surface of the male plants forming smaller or larger groups.

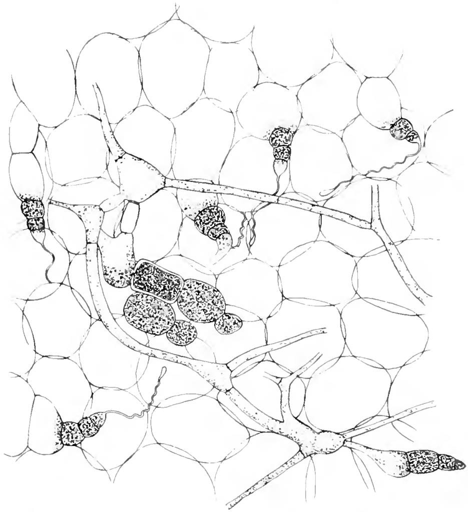

Fig. 356. *Agardhiella tenera* (J. Ag.) Schmitz. Part of the tissue seen from the innerside with auxiliary-cell branch and carpogonial branches. (About 250:1).

The procarps and carpogonial branches are formed on the inner side of the peripheral tissue facing the cavity in the thallus. We will therefore begin to examine a section of this tissue from the summit of a female plant. Fig. 356 shows a part of such a section; the innerside of it, which is facing the cavity of the thallus, is turned upwards. To make the organs of reproduction more clearly visible I have coloured the tissue in hæmatoxylin.

In the middle of the figure we find a short branch composed of rather robust cells. It originates from one of the filaments found on the innerside of the peripheral tissue, whose large cells are seen underneath. This branch consists at first of a smaller oblong cell, then follows a larger one having in this case an outgrowth on the left side. The next cell is especially coloured by the hæmatoxylin and filled to a great extent with granular cell contents; it has also a thicker wall than the other cells of the branch. This cell is the auxiliary cell. It always bears three cells. In the figure two of them only are visible, the third one is lying underneath the auxiliary cell.

But in Figure 357 showing a similar branch all three cells are seen. From these three cells the pericarp originates, in fig. 356 each of the two cells seen have already produced a single cell each.

Quite independently and separated from the auxiliary branch-system the carpogonial branches are developed. These are formed in much greater number than the auxiliary branches. In the part of the tissue shown in the Fig. 356 six are to be seen. The carpogonial branches are borne either from the large cells of the peripheral tissue or from the filaments found here. It consists of a variable number of cells, about two to four or sometimes five cells. The trichogyne is long, mostly screw-formed with a thickened summit; in penetrating the peripheral tissue it becomes thinner. In the figure the trichogynes of the carpogonial branch to the left and those of the carpogonial branches nearest to the right of the auxiliary branch have penetrated the peripheral tissue to become fertilized. After the fertilization the trichogyne gradually dies away, but at the same time the conjugating tube begins to grow out from the carpogone. The growing-out of this tube is seen in the carpogonial branch found close above the auxiliary branch in Fig. 356. Sometimes two or even three of those conjugating tubes are developed from the carpogone. These tubes are mostly very thin and may reach a considerable length; they protrude freely everywhere in the cavity of the thallus, until one of them succeeds in reaching an auxiliary cell. Then the summit of the tube becomes thicker and closely connected with it merging together with it. This process seems always to take place at the basal end of the auxiliary cell. Fig. 357 shows this stade of the fertilization; in this case the conjugating tube is issued from a carpogonial branch just

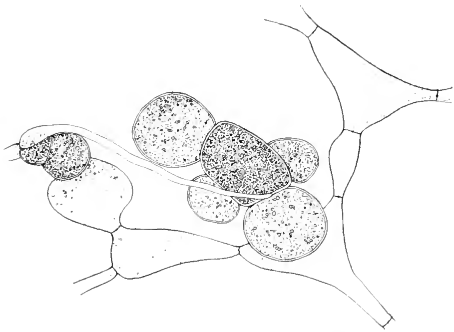

Fig. 357. *Agardhiella tenera* (J. Ag.) Schmitz. The process of fertilization. (About 350:1).

in the neighbourhood of the auxiliary branch, the conjugating tube being by reason of this much shorter and thicker than usual.

After the fusion with the conjugating tube the auxiliary cell cuts off a small cell at its upper end, the central cell, and, after numerous divisions this one gives rise, according to OSTERHOUT, to the gonimoblastic filaments from which the carpospores are developed. At the same time the pericarp is formed from the sterile cells.

The ripe cystocarp is a nearly spherical body lying imbedded in the cortical layer and extending far in to the medulla; it has a well developed carpostome.

An interesting fact is mentioned by OSTERHOUT. The tetrasporic plant is often provided with numerous short proliferations protruding to all sides. These originate from germinated tetrasporangia. A whole tetrasporangium is required for each proliferation.

The plant has been found with tetrasporangia, antheridia and cystocarps in the months January to March. It is gathered in shallow water with the exception of a single specimen dredged in a depth of about 30 meters.

The plant seems to be rather common at the islands. St. Croix: Christianssteds Lagoon, Saltriver, near Lt. Princess. St. Thomas: In the harbour of Charlotte Amalia. St. Jan: Cruz Bay, off America Hill.

Geogr. Distrib.: Warmer part of the Atlantic coast of North America, West Indies.

Subfam. 2. **Solieriæ.**

Rhabdonia Harv.

1. **Rhabdonia ramosissima** (Harv.) J. Ag.

J. AGARDH, Epicrisis, p. 593; Till Algernes Systematik, 4de afd. VII, Florideæ, p. 85.

Chrysymenia ramosissima Harv. Nereis Bor.-Am., p. 190, pl. XXX *B*.

f. *dilatata* J. Ag., l. c., p. 85.

The specimens found belong to the above form. The plant is fastened by means of a small disc. The thallus is at first nearly terete, but becomes soon compressed. The branches are given off from the edges and mostly regularly opposite, now and then also alternating or unilaterally. In vigorous plants this ramification is repeated several times. The growing point is composed of numerous diverging cell-filaments. Transverse and longitudinal secsions

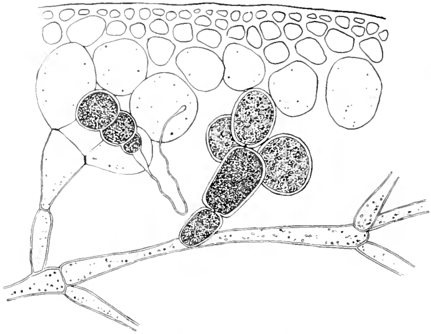
Fig. 358. *Rhabdonia ramosissima* (Harv.) J. Ag. Part of the tissue showing a carpogonial and an auxiliary-cell branch. (About 350:1)

of the plantshow that it is constructed in a way similar to that of *Agardhiella*.

Also the carpogonial branch and the branch bearing the auxiliary cell are, as Fig. 358 shows, formed in accordance with those found in *Agardhiella*. Both are formed from cells of the filaments at the interior wall of the peripheral tissue. The carpogonial branch consists of three cells; the thrichogyne is long, spirally bent and flattened in the upper end. The auxiliary cell bears three sterile ones. I have not been able to follow the development of the cystocarp in the material brought home by me.

The tetrasporangia are formed in the peripheral tissue and are zonately divided.

Plants with tetrasporangia and cystocarps were gathered in the month of March.

The plant was dredged in the more open sea in depth of about 10—15 fathoms. It was found rather sporadic and not in great number.

Some fragments of a nearly terete plant answering, as it seems, to the description of the forma *Harveyana* J. Ag., l. c., were once dredged.

St. Jan: In several places off Cruz Bay, off America Hill, off Annaberg.

Geogr. Distrib.: Key West.

Eucheuma J. Ag.

1. Eucheuma isiforme (Ag.) J. Ag.

Agardh, J., Nya alger fran Mexico (Öfvers. K. Vet.-Akad. Förh., 1847, p. 16); Species Alg., vol. II, p. 627; Epicr., p. 600. Harvey, Nereis Bor.-Am., p. 118, tab. 24.

Sphærococcus isiformis Ag., Spec. Alg., p. 271. Kützing, Spec. Alg., p. 777.

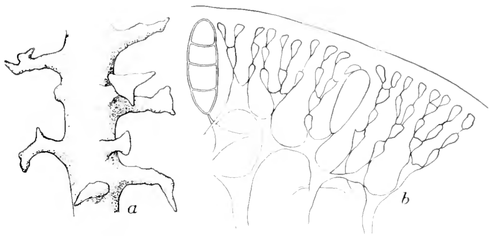

Fig. 359. *Eucheuma isiforme* (Ag.) J. Ag.
a, Part of the thallus with tetrasporangia.
b, transverse section of a branchlet with tetrasporangia.
(*a*, about $1^1/_2:1$; *b*, 70:1).

The specimens found were often more than a foot long. The thallus is of a very cartilaginous consistency; it is terete and, at any rate in the young specimens, oppositely or verticillately ramified. Some of the branches grow out to main branches like the mother branch; most of them remain short as spiny branchlets.

The summit of the thallus consists of several filaments densely packed together.

A transverse section shows that the thallus in the middle has a small medullary tissue composed of slender, but thick-walled cells. This is surrounded by a thick parenchymatic tissue whose cells are roundish-polygonal with rather thick walls. These cells are largest innermost growing gradually smaller towards the periphery. It is surrounded by the epidermal layer composed of short radiating filaments forming 2—3 layers of small, oblong, densely placed cells. At the periphery a rather thick epidermis is present.

A longitudinal section shows that the cells of the medulla are long, cylindrical. They are twisted between each other and now and then ramified. The cells of the parenchymatic tissue have nearly the same shape as when seen in transverse section.

Specimens with tetrasporangia and cystocarps are found. Both kinds of organs of fructification occur in the spiny branchlets (Fig. 359 *a*), the tetrasporangia also in the main stems.

The tetrasporangia occur scattered in the cortical layer (Fig. 359 *b*). This is rather much developed. The cell-threads which form it are longer and consist of more cells than in the vegetative plant. The tetrasporangia are formed as a side-branch from these filaments.

The mother-cell of the tetrasporangium increases much in size, especially in length, it becomes densely filled with granular contents and divided zonately in four spores.

The cystocarps are figured by HARVEY, l. c. They form rather large semiglobular bodies upon the branchlets with an opening in the upper end.

This plant has been found as well in shallow as in deep sea down to a depth of about 30 meters. When growing in shallow water the plant is very robust and does not reach any great height; in deep water it becomes more slender and more than a foot high. When found in shallow water it occurred in more protected places.

It was found with tetraspores and cystocarps in the month of March.

St. Croix: In the harbour of Christianssted. St. Thomas: Near the East end of the island; near Thatch Cay (leg. Dr. Th. Mortensen). St. Jan: Cruz Bay, near Great St. James.

Geogr. Distrib.: Florida, West Indies.

Genus incertæ sedis.

Wurdemannia Harv.

1. Wurdemannia setacea Harv.

HARVEY, W. H., Nereis Bor.-Am., Part II, p. 246. KÜTZING, F., Tab. Phycol., vol. XIX, tab. 26.

Fig. 360. *Wurdemannia setacea* Harv. Part of the thallus. (About $^2/_1$).

The plant forms low, dense tufts or cushions upon other algæ, stones etc. It consists of a filiform, terete, rather rigid thallus, ramified very irregularly to all sides and felted together (Fig. 360). Some of the branches grow out to main branches, others remain shorter or longer getting a spinelike appearance with their acute summits. The thallus is fixed to the substratum by means of small discs which can be

formed everywhere from the surface of the thallus. By means of such discs the filaments of the plant, too, fix themselves mutually together to each other. The connection is so intimate that mostly it is impossible to decide from which of the two connected filaments the hapteron is given off.

If we examine the apex of the filaments (Fig. 361 *c*) it appears that the thallus increases by means of several filaments placed

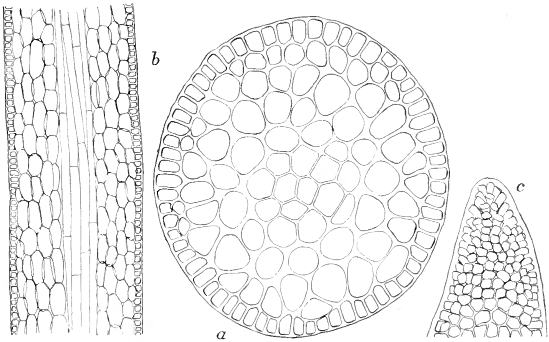

Fig. 361. *Wurdemannia setacea* Harv.
a, transverse section of the thallus. *b*, longitudinal section of the thallus. *c*, apex of a filament.
(*a*, about 240:1; *b*, about 130:1; *c*, about 80:1).

close together and from which the different cell-tissues are formed. Upon a transverse section of the thallus (Fig. 361 *a*) three different layers are visible. In the middle a medullary tissue is present composed of smaller thick-walled, roundish polygonal cells; from a longitudinal section (Fig. 361 *b*) it appears that these cells are rather long, cylindrical, but of variable length about 250 μ long at their greatest; the transverse walls are often somewhat oblique. Then follows a parenchymatic tissue, whose innermost cells are larger gradually diminishing outwards. A transverse section shows these cells to be nearly circular in outline, while a longitudinal section shows them to be actually oblong about 60 μ long. Finally, the epidermal tissue consists of a single layer of cells only; the cells are nearly as long as broad; when seen from above roundish polygonal; their diameter is about 12 μ.

My material was sterile.

The only known organs of reproduction are tetraspores; these have zonate division and occur immersed in the swollen ends of the branchlets.

At the islands I have dredged this plant in deep water only, at depths of about 20—30 meters.

St. Jan: In the sound between this island and St. Thomas in several places. St. Thomas: In the sea to the west of Water Island.

Geogr. Distrib.: West Indies.

V. Rhodymeniales.

Fam. 1. Sphærococcaceæ.

Subfam. 1. Ceratodictyeæ.

Gelidiopsis Schmitz.

1. Gelidiopsis rigida (Vahl) Weber-van Bosse.

Weber-van Bosse, A., Note sur deux algues de l'Archipel Malaisien (Recueil de travaux bot. Néerl., Vol. 1, p. 104, 1904). Okamura, K., Icones of Japanese Algæ, vol. II, 1912, p. 34 and p. 188, pl. 59, figs. 1—6.

Fucus rigidus Vahl, Beskrivelse over endeel cryptog. Planter fra St. Croix (Skrivter af Naturhistorie-Selskabet, 5. Bd., 2. Hefte, Kiobenhavn 1802, p. 46).

Gelidium rigidum (Vahl) Grev., Alg. Brit., p. LVII. Kützing, Spec. Alg., p. 766; J. Agardh, Spec. Alg., vol. II, p. 468; Epicrisis, p. 548.

Sphærococcus rigidus Ag., Spec. Alg., p. 285; Syst., p. 227.

Fucus corneus var. *spinæformis* Turn., Fuci, IV, p. 149.

Echinocaulon spinellum Kütz., Phyc. gen., p. 40; Spec., p. 762; Tab. phycol., vol. 18, tab. 38.

Echinocaulon ramelliferum Kütz., Tab. Phycol., vol. 18, p. 14, pl. 39.

Echinocaulon rigidum Kütz., Tab. Phycol., vol. 18, pl. 40.

Gelidiopsis rigida is a common alga upon coral reefs, stones, shells etc. upon which its decumbent base creeps; it forms more or less dense tufts upto a heigth of about 10 cm or more. It has a terete thallus of a very rigid, cartilaginous consistency and is rather

irregularly branched, some of the branches being very regularly pinnate or bipinnate, others bearing a few scattered pinnules or being quite barren.

Regarding the anatomical structure we find in the apex of the plant an apical cell usually rather broad with convex sides, sometimes also more conical (Fig. 362 *d*, *e*). At the base of this, watch-glass-shaped segments are cut off. From these segments

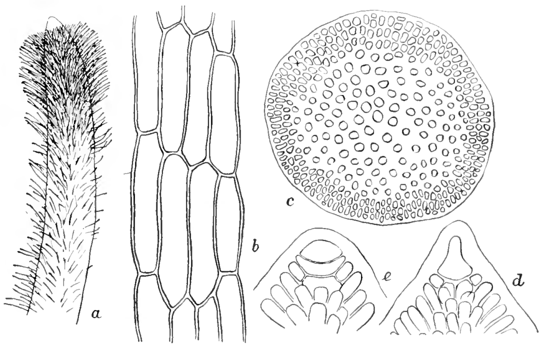

Fig. 362. *Gelidiopsis rigida* (Vahl) Weber-van Bosse.
a, summit of young thallus covered with hairs (about 50:1); *b*, longitudinal section of medullary cells (about 200:1); *c*, *d*, apices of two filaments showing the apical cell (about 500:1); *e*, transverse section of the thallus (about 70:1).

short filaments originate, diverging in all directions and these filaments are again gradually, by various divisions, transformed into a medullary tissue composed of thick-walled cells all of nearly the same size and an epidermal layer of densely placed small cells (Fig. 362 *e*). From a longitudinal section it appears that the cells of the medullary tissue are subcylindrical, about six times as long as broad with more or less oblique walls (Fig. 362 *b*).

When referring this plant to the genus *Gelidiopsis* M^me^ Weber was of the opinion that it had no apical cell, Okamura (l. c., fig. 6) being the first who observed it. Later on in the paper on "The Rhodophyceæ of the Percy Sladen Trust Expedition" (Transact. Linn. Soc., London 1914, vol. XVI, Zoology, p. 280) M^me^ Weber has corrected this mistake. In the above mentioned paper of Okamura good figures of this plant are found.

In the young parts of the thallus long unicellular hairs are given off from a great number of the peripheral cells forming a dense coating round the filaments (Fig. 362 *a*). These filaments are cylindrical—subclavate, being a little thicker in the upper end; they are about 200 μ long and 6—7 μ broad. They have very thin walls and are filled with protoplasma in the upper end.

In this plant tetrasporangia are the only known organs of reproduction. They occur in the upper apices of the pinnules which become swelled and conical in shape. They are formed here in great numbers in the peripheral tissue. The tetrasporangia are oblong, rather small, about 50 μ long and 27 μ broad; they are cruciately divided.

In a recently published list of algæ from Bermuda, HOWE*) has replaced this plant in the genus *Gelidium*, and he bases his opinion on the fact that *Gelidium cartilagineum*, which in several respects shows likeness to the present species, is allowed to remain in the genus. As pointed out by M[me] WEBER, it is especially the non-existence of the hyphæ in the middle of the thallus and the great resemblance of the stichidia of this genus to those of other species of *Gelidiopsis* which makes it most natural to place our plant in the genus *Gelidiopsis*.

Tetrasporangia were found in specimens gathered in the months of January and February.

This plant has originally been described upon specimens from St. Croix which VAHL received from Rector WEST, and these specimens are still in the Botanical Museum, Copenhagen.

It is a very common species at this island, growing upon coral reefs etc. in shallow water. At St. Thomas and St. Jan I have not gathered it with the exception of quite a small fragment dredged in the sea near the east end of the first mentioned island.

Geogr. Distrib.: Seems to occur in all warm seas.

Subfam. 2. **Gracilarieæ.**

Gracilaria J. Ag.

I regret to say that, in the determination of several of the species of this polymorphic genus, I have not always arrived

*) In N. L. BRITTON, Flora of Bermuda, New York 1918, p. 514.

at a definite conclusion, but to attain this result a monographic examination of a rich material af a large number of species is necessary in order to determine how the plants vary under different conditions.

How useful the examination of a large number of specimens is, Collins and Hervey, in their work: "The Algæ of Bermuda", have shown, when they had the opportunity of examining a large collection of specimens which had previously been referred to the three species *Gr. Wrightii*, *Poitei* and *cornea*. They arrived at the conclusion that they „can find no line of demarcation between the three species mentioned". They therefore refer all of them to one and the same species: *Gr. Wrightii*.

Some of the ten species recorded in the following list have been recorded from the islands by former investigators. Of several of these species I have found only very few specimens or such about which I feel a great doubt. This applies for instance to what is called *Gr. compressa*. I greatly doubt whether the few specimens I have referred to this species really belong to the European species and it is the same in the case of some dried specimens from St. Croix determined by J. Agardh and kept in the Botanical Museum, Copenhagen.

1. **Gracilaria confervoides** (L.) Grev.

Greville, R. K., Alg. Brit., p. 123. Harvey, Phycol. Brit., pl. 65. J. Agardh, Spec. Alg., vol. II, p. 587, Epicr. p. 413. Thuret et Bornet, Études phycologiques, p. 80, pl. XL.

For more references see De Toni, Sylloge Alg., vol. IV, Sect. II, p. 431.

The specimens referred to this species have a tissue of very large cells in the middle of the thallus, often more than 1 mm in diameter. The walls of the cells are very thin. This tissue is surrounded by a cortical layer one or two cells thick. When dry, the thallus quite collapses.

Plants with cystocarps were gathered in the month of January.

This species occurs in shallow water and in sheltered places. It often grows in localities with a sandy bottom sprinkled with stones to which the alga is attached.

St. Croix: Christianssted's harbour and lagoon; Lt. Princess, Green Cay; Longford.

Geogr. Distrib.: Warmer Atlantic coast of Europe, Morocco, Mediterranean Sea, West Indies, Cape, The Philippine Islands etc.

2. **Gracilaria ferox** J. Ag.

Agardh, J., Spec. Alg., vol. II, p. 592: Epicr., p. 414.

A few not very typical specimens may, I think, be referred to this species. The ramification and whole habit of this plant shows some likeness to *Gr. cervicornis*, but this last species has a compressed thallus. The branches are subdichotomously ramified, the ramuli short with acute apex, in the upper part of the thallus often aculeate.

From a transverse section of the thallus it appears that the cells in the middle are large, growing smaller outwards. They have thin walls. The cortical layer is thin, one to two layers thick.

The plant was once gathered on rocks near the shore in a rather exposed place, and once in the open sea at a depth of about 5 fathoms. According to J. Agardh it has previously been found at St. Croix, and in the Botanical Museum, Copenhagen, a specimen collected at this island by Ørsted, is present.

St. Croix: White Bay, off Frederiksssted.

Geogr. Distrib.: West Indies, Pernambucco.

3. **Gracilaria compressa** (Ag.) Grev.

Greville, R. K., Algæ Brit., 1830, p. 125. Harvey, Phycol. Brit., pl. 205. J. Agardh, Spec. Alg., vol. II, p. 593; Epicr., p. 417.

Sphærococcus compressus Ag., Spec. Alg., p. 308; System., p. 233. Kützing, Fr., Spec. Alg., p. 774; Tab. Phycol., vol. 18, pl. 78.

Comp. for more synonyms De-Toni, Sylloge Alg., vol. IV, Sect. II, p. 438.

Only a few not very typical specimens may, I think, be referred to this species. Compared with *Gracilaria confervoides* they especially differ on account of their somewhat thicker thallus and of the smaller cells in the interior of the filaments, their diameter reaching only a length of about 300 μ. The cells have thin walls. The cortical layer is thin, composed only of one or two layers of cells. The thallus is of a soft consistence and collapses in drying.

According to J. Agardh (l. c.) this species has been found

at St. Thomas and in the Herbarium of the Botanical Museum, Copenhagen, some specimens, determined by J. AGARDH, are kept; they are collected by ØRSTED near Christianssted at a depth of about 5 meters.

St. Croix: Coakley Bay.

Geogr. Distrb.: The warmer Altantic coast of Europe, Mediterranean Sea, West Indies, Mexico.

4. **Gracilaria caudata** J. Ag.

AGARDH, J., Spec. Alg., vol. II, p. 598; Epicrisis, p. 420.

The specimens referred to this species are, when dry, of a corneous-cartilaginous consistence. The main branches are ramified on all sides, upwards with shorter ramuli, the upper ends of the branches being bare.

From a transverse section the cells in the interior of the filaments are seen to be nearly of the same size as those in *Gr. compressa*, their diameter reaching a length of about 300 μ. But their walls are thicker, and the cells decrease more evenly outwards and pass evenly into the rather thick cortical layer (Fig. 363).

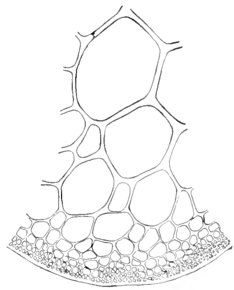

Fig. 363. *Gracilaria caudata* J. Ag. Part of a transverse section (About 60:1).

As I have had no authentic specimens at my disposal I do not feel convinced that my determination is right. In referring my specimens to this species I rely on the cartilaginous consistence of the thallus, only slightly collapsed when dry, and upon the anatomical structure.

Tetrasporic plants were found in the month of February.

It occurs in shallow water in more sheltered places and in the open sea at a depth of about 10 meters.

St. Croix: The harbour of Christianssted and Christianssted's Lagoon, Green Cay, off Frederikssted. According to J. AGARDH this species has previously been found at St. Croix.

Geogr. Distrib.: West Indies, Mexico.

5. **Gracilaria cylindrica** nov. spec.

Gracilaria Blodgetti Borgs., Some new or little known West Indian Florideæ (Bot. Tidsskrift, vol. 30, 1909, p. 18).

Frons usque ad 22 cm longa, e callo parvo, discoideo adsurgens, caule ad basin tenuiori, mox crassiori, terete, cylindrico, ca. $1^1/_2$—2 mm crasso, carnoso, exsiccatione collapso.

Rami sparsi, irregulariter undique orti, ad basin tenuiores, celeriter crassiores, teretes, cylindrici, apice late rotundati. Rami sæpe simplices, interdum ramosi, ramulos parvos in superiori parte gerentes.

Tetrasporangia sparsa, in cortice immersa. Cystocarpia verrucosa in superficie plantæ sparsa.

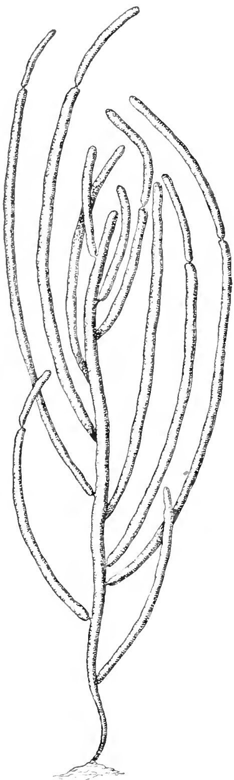

Fig. 364. *Gracilaria cylindrica* nov. spec. Habit of a plant. (About $^4/_5$ natural size).

After renewed examination and after having seen a specimen of *Gracilaria Blodgettii* Harv. it is evident to me that the plant, to which I previously have given this name, cannot be referred to this species, but must be regarded as a new species for which I propose the name *Gr. cylindrica*, referring to the nearly cylindrical thallus, which is only interrupted by the narrowings at the base of the branches (Fig. 364).

The plant reaches a height of about 22 cm. It is fastened to the substratum by means of a small disc. The main stem, being quite thin at its outgrowth from the disc, soon reaches the normal thickness of the thallus, about $1^1/_2$—2 mm and this thickness it keeps throughout. The branches are issued on all sides. The ramification is rather irregular with shorter or longer distance between the branches.

These are altogether a replica of the main stem. At their outgrowth from this they are quite thin, but rapidly obtain the normal size of the thallus keeping this through their whole length (often more than 10 cm) to their obtuse apex. The branches are mostly unbranched, but now and then they issue a

few branches of quite the same shape as their own; sometimes it may happen that such a branch is given off from the blunt apex of the mother branch.

The plant has a fine, clear-rose colour; it is somewhat diaphanous, of a fleshy succulent consistency. When dry it collapses completely, and it adheres mostly very well to the paper. A transverse section (Fig. 365 *c*) shows that the greater part of the tissue consists of large, transparent and thin-walled cells; outwards these become smaller and they are surrounded by a cortical layer consisting of one or two layers of rather small, thick-walled cells. Seen from the surface the cortical cells are irregularly polygonal (Fig. 365 *B*).

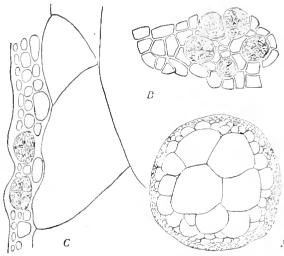

Fig. 365. *Gracilaria cylindrica* nov. spec.
A, transverse section of the thallus (about 8:1); *B*, surface of the thallus with tetraspores; *C*, transverse section of epidermal layer with tetraspores.
(*B* and *C* about 80:1).

In the tetrasporic plant the tetrasporangia occur scattered or in small irregular groups in the cortical layer (Figs. 365 *B*, *C*). The tetrasporangia are roundish of shape, their diameter reaching a length of about 40 μ.

The female plant bears the warty, dark-red cystocarps scattered over the surface.

The plant does not seem to approach any known *Gracilaria*. From *Gracilaria Blodgetti* it differs especially by the scarcer ramification and the obtuse apices of the branches.

The plant was found with tetraspores and cystocarps in the month of March. It was dredged in deep water about 10—15 fathoms.

The *Callithamnion cordatum* is a common and characteristic epiphyte upon this *Gracilaria*.

St. Jan.: Found in many places in the sound between this island and St. Thomas; and in the sea to the north of America Hill.

6. **Gracilaria usneoides** (Mert.) J. Ag.

J. Agardh, Spec. Alg., vol. II, p. 595; Epicrisis, p. 415.
Fucus usneoides Mert. mscr.
Sphærococcus usneoides Ag., Spec. Alg., p. 333.

This species has, according to J. Agardh, been found at St. Croix by Ørsted and in the Botanical Museum, Copenhagen, some fragments of Ørsted's plant are kept. These seem to show some likeness to *Gr. Wrightii*, but they are more densely ramified and the thallus collapses when it is dry.

Near Buck Island at St. Croix I have dredged a few specimens at a depth of about 5 fathoms which perhaps are referable to this species: they show much likeness to *Gracilaria Wrightii*, but the thallus is softer, the cells have thinner walls and they collapse therefore when dry.

Geogr. Distrib.: Brazil, West Indies.

7. **Gracilaria Wrightii** (Turn.) J. Ag., emend. Collins et Herv.

Collins and Hervey, Algæ of Bermuda, 1917, p. 109. J. Agardh, Spec. Alg., vol. II, p. 599 including *Gr. Poitei* (Lam.) J. Agardh, ibid. p. 596 and *Gr. cornea* J. Agardh, ibid., p. 598.

The specimens referred to this species are all coarse, thick plants of cartilaginous consistence. They are ramified very irregularly in every direction.

A transverse section of the thallus shows that it consists of a parenchymatic tissue of roundish, not very large cells, largest in the middle (about 180 μ broad) decreasing evenly towards the periphery. The walls of the cells are rather thick and often undulated, especially in the case of the small cells found between the larger ones. Towards the periphery the cells decrease, being about 20—30 μ thick. A longitudinal section, on the other hand, shows that the cells are rather long, about 170 μ, and have thick and sinuated walls. The cortical layer consists of short dichotomously ramified filaments composed of small oval cells; at the periphery a rather thick cuticula is found.

Specimens with tetrasporangia occurred in January and February.

The plant was found in shallow water in rather protected places.

St. Croix: White Bay, Lime Tree Bay. Some old specimens from the island are kept in the Herbarium of the Botanical Museum, Copenhagen.

Geogr. Distrib.: West Indies, Red Sea.

8. Gracilaria lacinulata (Vahl).

Fucus lacinulatus Vahl, Endeel kryptogamiske Planter fra St. Croix (1799) in Skrivter af Naturhistorie-Selskabet, 5. Bd., 2. Hefte, Kiobenhavn 1802.

Gracilaria multipartita (Clem.) J. Ag., Alg. Mediterr., 1842, p. 151; Spec. Alg., vol. II, p. 600; Epicr., p. 423. HARVEY, Phycol. Brit., pl. XV; Nereis Bor.-Am., p. 107.

Sphærococcus multipartitus Ag., Spec. Alg., p. 247.

Fucus multipartitus Clemente, Ensajo, Madrid 1807, p. 311 (non vidi).

For more synonyms compare DE-TONI, Sylloge Alg., vol. IV, Sect. II, p. 447.

We are obliged, I think, to take up VAHL's name for this plant. His description is clear and striking and cannot be misunderstood, even if the specimens, upon which he founded his description, cannot be identified with certainty at any rate at the present moment. This is of course a regrettable drawback. There is in the Herbarium of the Botanical Museum, Copenhagen, several old specimens (called *Fucus lacinulatus*) from the Danish islands which surely have been seen by VAHL, but none of these bear his handwriting.

And that the specific name of VAHL has been used for this plant is shown, too, by the careful drawing of this plant reproduced here (Fig. 366). It is found in a book containing drawings of several algæ originating from Professor FR. WEBER in Kiel and later presented to the Botanical Library, Copenhagen by his royal Highness Prince CHRISTIAN.

Nr. 366. *Gracilaria lacinulata* (Vahl). Compare the text.

Among the rather few specimens, which I have gathered myself, forms are found which approach partly to the var. *granatea* (Turn.) J. Ag. (= *Fucus*

granateus Turner, Fuci, pl. 215), and partly to the var. *æruginosa* (Turn.) J. Ag. (= *Fucus æruginosus* Turner, Fuci, pl. 147). Besides I have some few specimens approaching the var. *polycarpa* (Grev.) J. Ag. and some others most likely referable to the var. *angustissima* Harv. These last mentioned specimens are quite terete at their base, but in the upper part the thallus is a little flattened being at the same time more or less bi-trifurcate. Some of these specimens were lying loose upon the bottom.

Gracilaria lacinulata occurs in shallow water near the shore, partly in sheltered places, partly in more exposed.

St. Croix: Longford, Christianssted's harbour, White Bay, Salt River, Buck Island.

Geogr. Distrib.: Warmer Atlantic coast of Europe and America, Mediterranean Sea.

9. Gracilaria dentata J. Ag.

Agardh, J., Spec. Alg., vol. II, p. 603; Epicr., p. 424.
Sphærococcus oligacanthus Kütz., Tab. Phycol., vol. XVIII, pl. 87.
Sphærococcus rangiferinus Kütz., ibd. pl. 86.

The specimens found seem to agree very well with J. Agardh's description. They have a thicker, more firm and cartilaginous thallus than that of *Gracilaria lacinulata*. The thallus is several times bi-tripartite, in the upper end flabellate. Along the margin the specimens are more or less dentate. Some of the specimens lack the dents. These bear a close resemblance to some specimens in my collection from Jamaica, gathered some years ago at this island by Mr. O. Hansen and determined by the late Major Reinbold to be a form intermediate to the var. *polycarpa* of *Gr. lacinulata*.

Transverse sections of the thallus show that the cells in the present plant are much smaller than those of *Gr. lacinulata*, about 200 μ lat. The cells become smaller outwards and are surrounded by the cortical layer which consists of a few layers of cells, oval of shape.

The *Fucus denticulatus* of Vahl (in Skrivter af Naturhistorie-Selskabet, 5te Bind, 2. Hefte, p. 45) is most probably this species. But as his diagnosis is rather short and as I have seen no specimens from Vahl's time, I do not think it right to reestablish his specific name.

Plants with tetraspores were found in the month of February.

It has been gathered in shallow water near the shore in rather exposed places.

St. Croix: White Bay, Long Reef, Lt. Princess.

Geogr. Distrib.: West Indies.

10. **Gracilaria cervicornis** (Turner) J. Ag.

Agardh, J., Spec. Alg., vol. II, p. 604; Epicr., p. 425.

Fucus cervicornis Turner, Fuci, pl. 121.

For more synonyms comp. De-Toni, Sylloge, vol. IV, Sect. II, p. 452.

I have not myself gathered this species at the islands, but according to J. Agardh it has previously been found at St. Croix. And some old specimens from St. Croix are kept in the Herbarium of the Botanical Museum, Copenhagen. Some of these are most probably collected by Rector West and sent to Vahl; but being without his signature, this question cannot be settled.

It seems to me that the description of *Fucus versicolor* given by Vahl in the year 1802 in „Skrivter fra Naturh.-Selskabet", vol. 5, part 2, p. 44 on the whole answers to this species, but when the „dentibus“ are said to be "obtusissimis" it does not correspond with this plant.

Geogr. Distrib.: West Indies, Mexico, Brazil.

Subfam. 3. Hypneeæ.

Hypnea Lamouroux.

Collins and Hervey point out in the "Algæ of Bermuda", p. 112—13 that the species of *Hypnea* are generally so poorly defined that any exact determination is mostly excluded.

The representatives of the genus *Hypnea* seem to be very variable plants, varying much according to their different growing places. Several of the species described are most probably nothing else but forms of the same plant.

1. **Hypnea musciformis** (Wulf.) Lamour.

Lamouroux, Essai Thalassioph., p. 43. Kützing, Fr., Spec. Alg., p. 758; Tab. Phycol., vol. 18, tab. 19. J. Agardh, Spec. Alg., vol. II, p. 442; Epicr., p. 561.

Fucus musciformis Wulf. in Jacquin, Collectanea, III, p. 154, tab. 14, fig. 3 (non vidi). Esper, Icones Fuc., tab. 93. Turner, Fuci, tab. 127.

For more synonyms compare De-Toni, Sylloge Alg., vol. IV. Sect. II, p. 472.

This is a common species along the shores of the islands. It occurs in shallow water and mostly in more sheltered places, but it is also found in somewhat exposed localities.

In the last mentioned places where the light, too, was strong some specimens were gathered which were covered quite densely with long, unicellular, hyaline hairs. These hairs serve most probably as a protection against strong light*) being present in so many littoral algæ and non existing or less developed in those from deep water. That the hairs, on the other hand, also may serve as absorbing organs of nutriments, is very likely**).

Hypnea musciformis is often an epiphyte upon larger algæ and occurs commonly entangled among other algæ to which it fixes itself by means of the tendrils.

Specimens with tetrasporangia were found in the month of February.

St. Croix: Christianssted's harbour, Christianssted's Lagoon, Lt. Princess, White Bay, Casavagarden etc. St. Thomas: Store Nordsidebugt. St. Jan: Coral Bay, Cruz Bay.

Geogr. Distrib.: Seems to occur in all warmer seas.

Fig. 367. *Hypnea cornuta* (Lamour.) J. Ag. Part of a plant. (About 3:1).

2. **Hypnea cornuta** (Lamour.) J. Ag.

J. Agardh, Spec. Alg., vol. II, p. 449; Epicr. p. 563.
Gigartina cornuta Lamour. mscr.
Chondroclonium cornutum Kütz., Spec. Alg., p. 741.

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*) Vide Berthold, G., Beiträge zur Morphologie und Physiologie der Meeresalgen. Pringsh. Jahrb. f. wiss. Bot., Bd. 13, 1882 p. 675.

**) Rosenvinge, L. Kolderup: Remarks on the hyaline unicellular hairs of the Florideæ (Biol. Arbejder tilegnede Eug. Warming, Kobenhavn 1911).

The plant (Fig. 367) is characterized by the small, stellate, spiny branchlets found scattered upon the filaments. They have 3—5 rays and are peltately fixed to the branches. Tendrils are now and then present, but not upon all specimens. The plant forms rather large, richly ramified bushes up to about 20 cm high.

A transverse section (Fig. 368) of the thallus shows rather large cells in the middle, smaller towards the periphery. The cortical layer consists of a single layer of cells which have a very thick cuticula often 25—30 μ thick. A longitudinal section shows that the cells in the middle are about 3—4 times longer than broad.

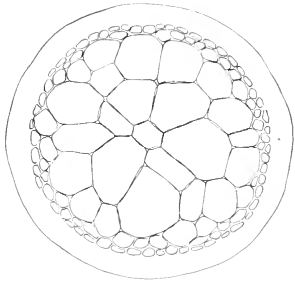

Fig. 368. *Hypnea cornuta* (Lamour.) J. Ag. Transverse section of the thallus. (About 100:1).

The *Acrochætium Hypneæ* described on page 51 of this volume is found upon this plant in whose thick cuticula its basal part is immersed.

This species has been found a few times in sheltered places in shallow water.

St. Thomas: in the harbour of Charlotte Amalia; St. Croix: near Christianssted. Ørsted has gathered it as St. Thomas.

Geogr. Distrib.: West Indies, Guinea, Japan etc

3. Hypnea cervicornis J. Ag.

J. Agardh, Spec. Alg., vol. II, p. 451; Epicrisis, p. 546.
Hypnea spinella Kütz., Tab. Phycolog., vol. 18, tab. 26.

The specimens referred to this species form roundish bushes composed of numerous, much branched filaments. No main branches are present, all the branches being of nearly the same size and mostly rather thin. The ramification is very irregular, the branchlets longer or shorter with acute apices. Frequently the upper ends of the filaments get an antler-like appearance being often curved and their branchlets decreasing in length towards the top.

Some of my specimens might perhaps quite as well be referred to *Hypnea divaricata* Grev. of which some specimens from

St. Croix and St. Thomas, collected by ØRSTED and determined by J. AGARDH, are kept in the Herbarium of the Botanical Museum, Copenhagen. I have specimens which are quite identical with these. They seem to be like a more densely branched form of the present one.

It seems to me very likely that the specimens I have referred to this species are only forms from more protected places, and those referred to the following species, *Hypnea spinella*, nothing else but forms from more exposed places.

This species occurs in more protected places in shallow water, but it has also been dredged in deep sea at a depth of about 30 meters. It was found with tetrasporangia and cystocarps in the months of February and March.

It is a common species along the shores of the islands.

Geogr. Distrib.: Seems to occur in most warmer seas.

4. **Hypnea spinella** (Ag.) Kütz.

KÜTZING, Spec. Alg., p. 759. J. AGARDH, Spec. Alg., vol. II, p. 453; Epicrisis, p. 565.

Sphærococcus spinellus Ag., Spec. Alg., p. 323; Systema, p. 237.

This plant forms small compact tufts upon rocks.

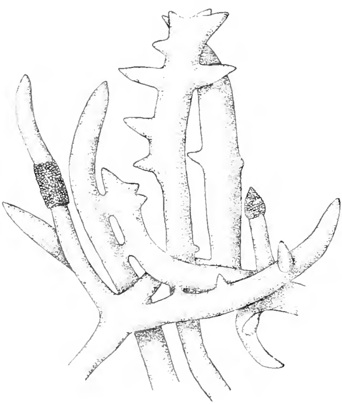

Fig. 369. *Hypnea spinella* (Ag.) Kütz. Part of a plant with anastomosing branches and fertile parts with tetrasporangia (about 10:1).

The plant is very irregularly ramified (Fig. 369); the branches are issued in all directions, in some cases with larger distance between them, in others several branches are crowded together. Some of the branches grow out to main filaments, most of them become small, short, spinelike branchlets of variable length.

These much branched filaments are felted between each others and further often anastomosing to each others by means of rhizoids breaking out everywhere from the thallus (Fig. 369).

The tetrasporangia are formed in the branchlets. The fertile part of these is thicker than the sterile one. The quite short branchlets become fertile in their whole length, the longer in their upper end; sometimes a fertile zone is found in the middle part of a branch (Fig. 369).

The plant grows in shallow water near the shore in somewhat exposed places where the waves often dash the rocks constantly. It seems to me rather probable that this plant is only but a dwarfish form of the preceding species adapted to the conditions of life of the more exposed localities.

The plant has been found with tetraspores in the months of December and January and with cystocarps in the month of February.

St. Croix: White Bay; St. Thomas: In several places near Charlotte Amalia. St. Jan: Cruz Bay.

Geogr. Distrib.: West Indies.

Fam. 2. *Rhodymeniaceæ.*

Subfam. 1. Gloiocladieæ.

Gloiocladia J. Ag.

1. **Gloiocladia** spec.

Only a single sterile plant has been found. It forms a small roundish tuft, about 3 cm high and has, when dry, a beautiful rosy colour. The thallus is flat, repeatedly forked, its divisions being about 3 mm broad; it seems to be somewhat twisted. The upper ends of the thallus are more or less emarginate with obtuse corners.

A transverse section of the thallus shows that it is composed of two different cell-tissues (Fig. 370 *a*, *b*).

In the middle of the thallus a layer of very large transparent cells are found; these are about 180 μ thick and often more than 400 μ long. Seen from above these cells have more or less undulated walls and are mostly one and a half to twice as long as broad (Fig. 370 *c*). For the most part this tissue consists of a single layer of cells, but a few times I have found the large cells divided into a number of smaller cells (compare Fig. 370 *a*).

The epidermal layer consists, in the parts nearest to the large

cells in the middle, of irregularly shaped, tri-polygonal cells with elongated corners; from these cells short, several times forked, moniliform filaments emerge, these being composed of small oval cells (Fig. 370 *a*, *b*). The cells in the filaments are about 6—7 μ thick.

The consistency of the thallus is very gelatinous.

I have referred this doubful plant to *Gloiocladia* as it, to a great extent, bears a close resemblance to this genus. Of *Gloio-*

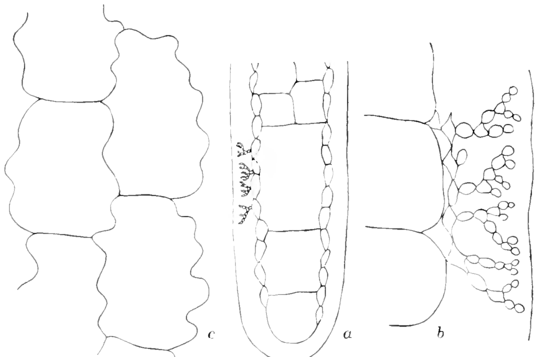

Fig. 370. *Gloiocladia* spec.
a, transverse section of the thallus (about 80:1); *b*, part of the same more magnified (about 300:1); *c*, cells from the middle of the thallus seen from above (about 300:1).

cladia a single representative, *G. furcata* from the Mediterranean Sea, is known up to the present time (compare Zanardini, Iconographia Phyc. Adriat., vol. I, p. 13, pl. 4 A). When compared with this plant the West Indian one differs nevertheless in several respects. Thus it must be pointed out that its thallus is broader and flat throughout its whole length and the upper ends of the thallus are obtuse.

As to the anatomical structure the most essential difference between the two plants is that while the tissue in the interior of the thallus in my plant consists mostly of a single layer only, in the Mediterranean plant with its thicker thallus this tissue is composed of several layers.

Hence, it is most probable, we have to do with a new spe-

cies which is a West Indian representative of this genus, but, having had so very little and quite sterile material at my disposal, I prefer to leave it unnamed.

The plant was dredged in deep sea at a depht of about 15 fathoms.

St. Jan: off Annaberg.

Subfam. 2. Rhodymenieæ.

Rhodymenia Grev., J. Ag.

1. Rhodymenia occidentalis nov. sp.

Frons plana, membranacea, 25 cm longa et ultra, crebre dichotomo-furcata, subflabellata, furcationibus angustioribus, laciniis ca. 4 mm latis, margine nuda, interdum prolifera, summis late rotundatis, basi subterete-stipitata.

Frons ex duobus stratis composita, cellulis exterioribus corticalibus minutis, interioribus ad medium versus gradatim majoribus, rotundatis-polygonatis.

Organa fructificationis ignota.

The plant is fastened to the substratum by means of a disc from which proliferations often arise. The thallus is flat, membranaceous. It is narrow near the base, but scarcely quite terete; upwards it is evenly broadened out until it reaches its normal breadth, about 4 mm. The thallus is repeatedly forked; in the

Fig. 371. *Rhodymenia occidentalis* nov. spec. Part of a plant. (About 2/3).

basal part the distance between the furcations is shorter than upwards. At each furcation the thallus is much narrowed being often here only 1 mm broad.

Besides this normal ramification proliferations are now and then issued from the margin of the thallus especially near the narrowings. The thallus is slightly sinuated. The apex of the thallus is broadly rounded.

From a transverse section is seen that the thallus consists of cells which are largest in the middle (about 150 μ thick) and

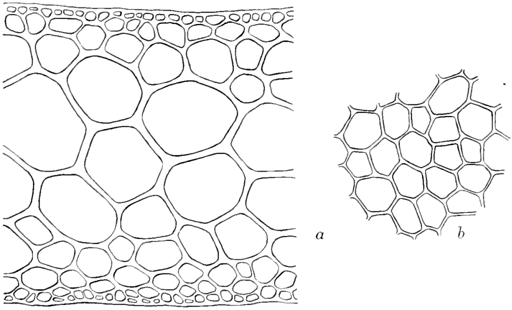

Fig. 372. *Rhodymenia occidentalis* nov. spec.
a, transverse section of the thallus (about 125:1); *b*, part of the cortical layer seen from above (about 350:1).

decreasing evenly outwards (Fig. 372, *a*). All the cells have very thick walls. This parenchymatic tissue is surrounded by a cortical layer composed of a single layer of cells; in transverse section these are roundish polygonal, seen from above polygonal (Fig. 372 *b*).

Neither tetraspores nor other organs of reproduction were found in the material.

Considering its entire structure it seems to me that the plant agrees very closely with *Rhodymenia*, but, if its organs of reproduction should be found, it is, of course, not impossible that it may turn out to be, for instance, a *Gracilaria*.

As to species of *Rhodymenia* with which our plant may be compared, *Rh. flabellifolia* (Bory) Mont. (= *Sphærococcus tenui-*

folius Kütz., Tab. phycol., vol. 18, pl. 93), *Rh. linearis* J. Ag., *Rh. ligulata* Zanard. etc. may be pointed out.

The plant was found at a depth of about 10—15 fathoms of water. It was growing, apparently rather abundantly, in the sound between St. Thomas and St. Jan as a component of the very rich algal vegetation found here.

St. Jan: Found in several places in the sound between this island and St. Thomas: off Cruz Bay, near Great St. James, off Hermitage, off Annaberg.

Coelothrix nov. gen.

Frons rigida, filiformis, ex numerosis filamentis arcte conjunctis orta, tubulosa, in interiori parte cava, irregulariter ramosa, ramis sparsis, interdum secundis et inter se conglomeratis, interdum anastomosantibus cæspites densos formantibus.

Frons ex duobus stratis composita, exteriori cortice unistrato, cellulis minoribus densis, interiori cellulis gradatim majoribus, rotundatis-polygoniis, cavitatem versus glandes sparsas gerentibus.

Tetrasporangia apici inflato ramorum inhabita.

1. Coelothrix irregularis (Harv.)

Cordylecladia? irregularis Harv., Nereis Bor.-Am., part II, p. 156.

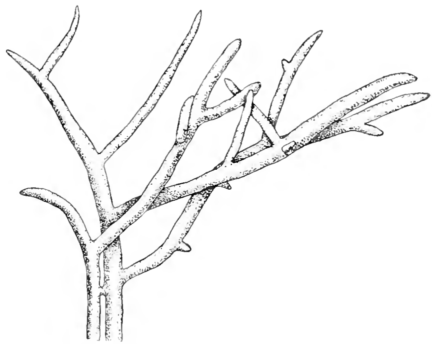

Fig. 373. *Coelothrix irregularis* (Harv.). Part of a plant. Below two branches with anastomose. (About 4:1).

When Harvey referred this plant to the genus *Cordylecladia* he put, no doubt correctly, a query behind the name as the structure of this plant differs greatly from that of the type species: *Cordylecladia erecta*, a transverse section of which being very like that of *Gracilaria*. Considering the structure of the thallus, especially since this is hollow as already pointed out by Harvey, and the glands found upon the cells facing the

cavity, the plant seems to me to be much closer related to, for instance, *Chrysymenia* and *Chylocladia*, even if it cannot in a natural way be referred to any of these genera. On account of this I propose to consider it as a representative of a new genus.

I have not found this plant myself and my description is therefore, unfortunately, rather poor, having had but some old dried specimens, preserved in the Botanical Museum, Copenhagen, at my disposal. But the plant seems to stand drying rather

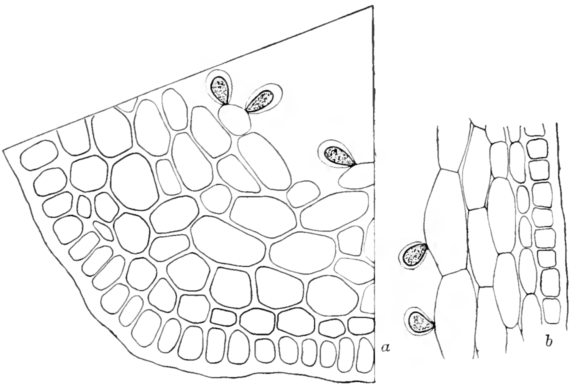

Fig. 374. *Coelothrix irregularis* (Harv.).
a, transverse section of the thallus (about 275:1);
b, longitudinal section (about 200:1).

well and, after having been steeped in water, to reassume fairly well its original appearance.

The plant (Fig. 373) forms low cushions composed of the rather rigid and very irregularly branched filaments felted together; they are fastened to the substratum by means of numerous groups of rhizoids, these being able to break out everywhere from the thallus. By means of such rhizoids the filaments in the cushions, too, are mutually connected; a group of surface cells grow out rhizoid-like from both filaments and anastomose in a way very similar to that in *Wurdemannia* (comp. Fig. 360).

The ramification is very irregular the branches being issued, with shorter or longer intervals on all sides, sometimes with a tendency to be second.

The growing point in the apex of the thallus consists of numerous filaments packed together and with diverging apices.

A transverse section (Fig. 374 *a*) of the thallus shows at the periphery a single row of oblong cells placed densely together; these cells are about 28 μ long and 16 μ broad. Next to this layer a parenchymatic tissue follows whose cells are roundish and gradually increase towards the cavity being at the same time somewhat looser connected. The innermost cells protrude more or less freely into the cavity and carry now and then glands (Fig. 374 *a*)

A longitudinal section (Fig. 374 *b*) shows that the peripheral cells are nearly square; the cells of the parenchymatic tissue are rather long, about 2—3 times as long as broad.

The specimens examined were sterile; I thought in one of the specimens to have found tetrasporangia, but a more thorough examination showed that these originated from a *Hypnea* whose filaments were densely interwoven between those of *Coelothrix*. But Collins*) mentions having found tetraspores, and Howe**), too, mentions such ones. According to him "the tetrasporangia occur on pod-like enlargements of the ends of certain branchlets". Collins also mentions having found cystocarps; these "are spherical and external on the branches". A more detailed description of these organs would be highly desirable.

In "The Algæ of Bermuda" Collins and Hervey name the plant *Cordylecladia rigens*, referring it to the *Chylocladia rigens* J. Ag. (= *Sphærococcus rigens* C. Ag.). Howe, l. c., p. 516 points out that "the type of *Sphærococcus rigens* Ag. is a Japanese plant different in structure from the Bermudian and West Indian."

The specimens preserved in the Botanical Museum, Copenhagen, are partly "ex ins. St. Crucis, misit Palle Bang", partly from "St. Jan., Dr. Ravn." They are labelled *Sphærococcus durus* Ag. var.

Geogr. Distrib.: Florida, Bermuda, Jamaica.

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*) Collins, Fr. S., The Algae of Jamaica (Proceed. Am. Acad. of Arts and Sciences, vol. 307, 1901, p. 255).

**) Howe in Britton, Flora of Bermuda, 1908, p. 516).

Chrysymenia J. Ag.

In some introductory remarks to a former paper of mine*) concerning this genus I have pointed out that the bursting of the thallus, as described by SCHMITZ and HAUPTFLEISCH, and the peculiar way in which, according to these authors, the gland-cells in the cavities of the *Chrysymenias* are supposed to come into existence does not hold good in case of a more thorough examination. In a paper of the late Prof. KUCKUCK**), whose early death is sincerely to be regretted, this prominent investigator

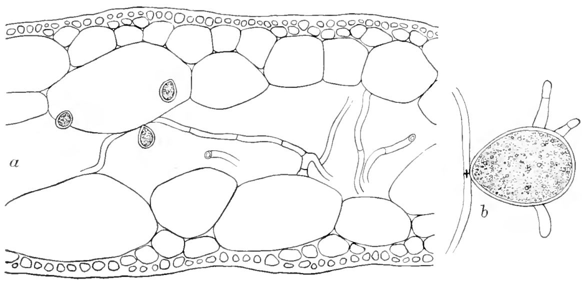

Fig. 375. *Chrysymenia Agardhii* Harv.
a, transverse section of the thallus (about 80:1);
b, gland-cell with filaments (about 350:1).

quite agrees with me regarding the development of the cavities and glands of the *Chrysymenias*.

In the same paper I also mentioned that the shape of the gland-cells and their arrangement upon the innerside of the large wall cells seem to be of much specific value.

1. Chrysymenia Agardhii Harv.

HARVEY, W. H., Nereis Bor.-Americana, Part. IV, p. 189, tab. XXX A. AGARDH, J., Epicrisis, p. 322. BØRGESEN, F., Some new or little known West Indian Florideæ, II. (Bot. Tidsskr., vol. 30, 1910).

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*) BØRGESEN F., Some new or little known West Indian Florideæ, II (Botanisk Tidsskrift, vol. 30, 1910, p. 181).

**) KUCKUCK, P., Beiträge zur Kenntnis der Meeresalgen, 13, Untersuchungen über Chrysymenia (Wiss. Meeresuntersuchungen. Neue Folge, V. Bd., Abt. Helgoland, Oldenburg, 1912).

A few specimens of this plant have been found. They are fixed to the substratum by means of a small disc, having a cuneate rapidly expanded base which is afterwards divided into several lobes. These lobes bear along their margin several smaller ramifications, in my specimens they are of an elongated oblong shape tapering towards both ends.

The thallus is flat, compressed, in places nearly compact, but here and there smaller or larger openings are present between the innermost large cells (Fig. 375 *a*). These cells are

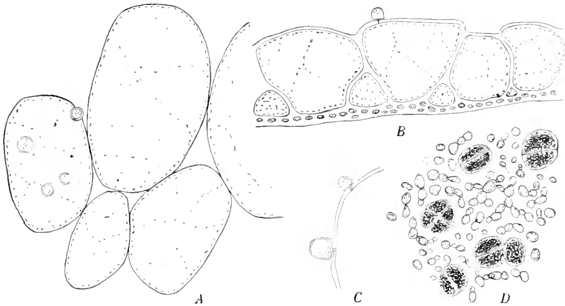

Fig. 376. *Chrysymenia Agardhii* Harv.
A, wall of frond seen from innerside; the cell to the left with glands (70:1); *B*, transverse section of the wall; the cell in the middle with a gland (70:1); *C*, part of a cell with glands (170:1); *D*, tetrasporangia in the cortical layer (170:1).

oblong to oval of shape when seen from the surface (Fig. 376 *A*), in transverse section irregularly polygonal (Fig. 376 *B*). The surface consists of a dense layer of small cortical cells covering the underlying large cells completely.

On their innerside, facing the cavities in the interior of the thallus, one of the large cells bears here and there a few (2—4 seldom more) scattered gland-cells (Fig. 375 *a*, 376 *A*). These are globular to obovate.

Furthermore hyphæ-like filaments grow out in all directions from the innerside of the large wall cells filling up the cavities more or less (Fig. 375 *a*). These filaments have transverse walls and are sometimes ramified. The cells in the filaments are nearly cylindrical, about 20 μ thick and five to eight times as long. Such

filaments are sometimes issued from the gland-cells too (Fig. 375 *b*).

Only tetrasporic plants occurred. The tetrasporangia are developed in the cortical layer (Fig. 376 *D*). They are cruciately divided and rather small, about 27 μ broad. They occurred in the month of March.

This species has been found in deep water only (about 12—16 fathoms).

St. Jan: Off Cruz Bay and near Great St. James; off America Hill where it was collected by Dr. TH, MORTENSEN and myself.

Geogr. Distrib.: Florida.

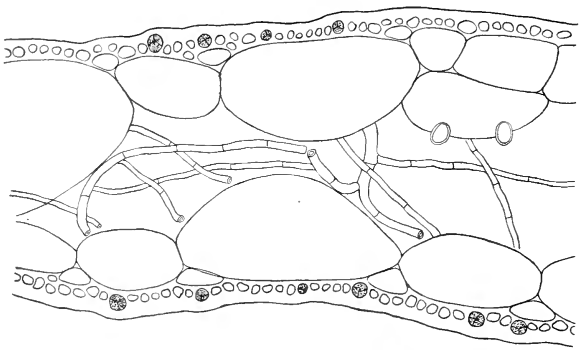

Fig. 377. *Chrysymenia planifrons* (Melv.) J. Ag.
Part of a transverse section of the thallus with tetrasporangia (about 80:1).

2. **Chrysymenia planifrons** (Melv.) J. Ag.

J. AGARDH, Epicr. p. 319.

Chrysymenia Agardhii var. *planifrons* Melville, Notes on the Algæ of South Carolina and Florida (Journ. of Botany, vol. XIII, 1875, p. 263).

A fragment of a *Chrysymenia* with flat thallus is, most probably, referable to this species. It originates from a tetrasporic, and rather old plant.

A transverse section (Fig. 377) of the thallus bears a close resemblance to that of *Chrysymenia Agardhii.* In the middle it is more or less hollow and the cavities are more or less filled up with numerous hyphæ issued abundantly from the large wall

cells. The gland-cells are placed in the same way, having nearly the same shape as in *Chrysymenia Agardhii*. Also in this plant hyphæ were found growing out from the gland-cells.

It cannot be denied that this plant, on the whole, comes very near to *Chrysymenia Agardhii* and that MELVILLE is right in considering it as a variety only of this species. The only difference between the two forms seems to be that the thallus in *Chrysymenia planifrons* is not divided, being very broad.

The plant was gathered in the month of March. It was dredged in rather deep water, about 30 meters.

St. Jan: Off Cruz Bay.

Geogr. Distrib.: Florida.

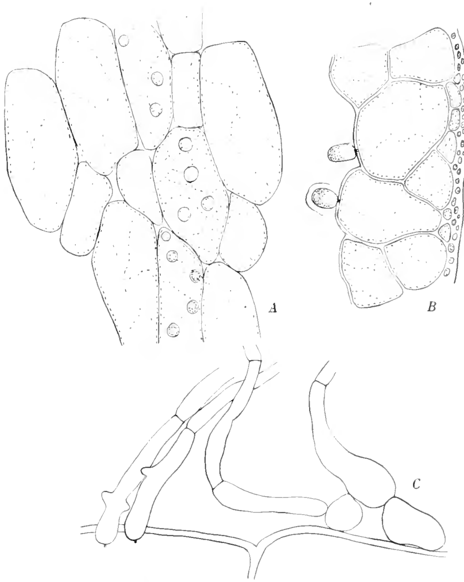

Fig. 378. *Chrysymenia ventricosa* (Lamour.) J. Ag. *A*, large cells facing the cavity of the thallus, those in the middle with glands (70:1); *B*, transverse section of the wall with two glands (70:1); *C*, transverse section of an older part of the thallus showing hyphæ-like filaments growing out from the innerside of the large cells (125:1).

3. Chrysymenia ventricosa (Lamour.) J. Ag.

J. AGARDH, Alg. Medit., 1842, p. 106; Spec. Alg. vol. II, p. 213; Epicrisis, p. 323. F. BØRGESEN, Some new or little known W. I. Florideæ, II, 1910, p. 183, fig. 3. KUCKUCK, Untersuch. über Chrysymenia (Beiträge zur Kenntnis der Meeresalgen, 13, p. 218, pl. XIII, figs. 16—21).

Dumontia ventricosa Lamour., Essai Thalassiophyt., 1813, p. 45, tab. 10, fig. 6.

Halymenia ventricosa Ag., Spec. p. 212. Kützing, Tab. Phycol., vol. 16, tab. 86.

Halymenia pinnulata Ag., Aufzählung etc. (Flora X, 1827, p. 645).
Chrysymenia pinnulata J. Ag., Alg. Mediter., p. 106; Spec. Alg., II, p. 212; Epicr., p. 323. Zanardini, Iconogr. Adriat., I, p. 151, pl. 36 A.

The wall of this rather large plant consists of several cell-layers; innermost, towards the cavity in the interior of the frond, the cells are large, becoming smaller outwards (Fig. 378 *B*). The cortical layer consists of larger cells innermost, smaller at the periphery; it is beautifully figured by Kuckuck (l. c., p. 219, pl. XIII, fig. 17) who, on the other hand, found the cortical layer composed of short moniliform filaments consisting of small roundish cells. This was not so marked in the West Indian specimens except in the tetrasporic plant.

Here and there, on the innerside of the large cells facing the cavity in the interior of the thallus, a single one of these cells or a few consecutive ones bear glands (Fig. 378 *A*). These glands are as a rule placed immediately upon the membrane of the large cells, more rarely I have found a few of the glands placed upon a small roundish cell while the remaining glands were placed immediately upon the wall of the large cell. In specimens from the Mediterranean Sea Kuckuck mentions that he also now and then has found such a small cell between the gland cell and the large cell (compare his fig. 19, pl. XIII). The glands seem always to be solitary, but several occur on each cell. The glands are oblong-roundish when seen from the side (Fig. 378 *B*).

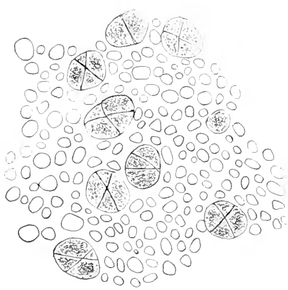

Fig. 379. *Chrysymenia ventricosa* (Lamour.) J. Ag. Tetrasporangia in the cortical layer (250:1).

Further, in the older part of the thallus (comp. my remarks l. c., p. 181) we find hyphæ-like filaments growing out from the innerside of the large wall cells (Fig. 378 *C*). These filaments are irregularly bent, often swollen in their lowermost part, nearly cylindrical in their upper part consisting of cells about 16 μ thick and 6—12 times as long. The filaments are now and then ramified, Kuckuck has found similar hyphæ in the Mediterranean plant. A few times small nearly globular glands occurred upon the filamemts.

The tetrasporangia are produced in the cortical layer and occur scattered over the whole thallus. They are about 20 μ broad and cruciately divided (Fig. 379). Kuckuck gives (l. c., p. 223) a transverse section of the wall with tetrasporangia.

The cystocarps are likewise found scattered over the surface of the thallus; they are hemispherical prominent and have an apical porus. Tetrasporangia and cystocarps occurred in the month of March.

At the islands this species has been found in deep sea only (about 12—15 fathoms); according to Berthold*) and Kuckuck (l. c., p. 218—19) it occurs too in shallow water in the Mediterranean Sea. But it is also found there in deeper water, and Rodriguez**) found it even at a depth of 130 m at the Baleares.

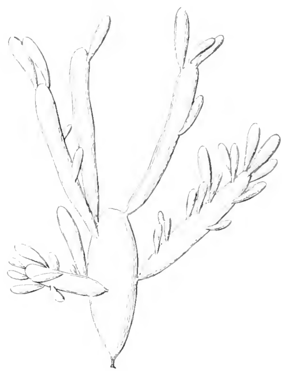

Fig. 380. *Chrysymenia Enteromorpha* Harv. (about natural size).

St. Jan: In many places in the sound between this island and St. Thomas and in the sea to the north of St. Jan.

Geogr. Distrib.: Mediterranean Sea, Morocco.

4. Chrysymenia Enteromorpha Harvey.

Harvey, Nereis Bor.-Americana, Part II, p. 187. F. Børgesen, W. I. Florideæ, II, p. 185. J. Agardh, Epicrisis, p. 325.

Of this fine plant (Fig. 380) I have found a few specimens in deep water. They reached a length of more than ten cms (in the biggest specimen collected the basal part was absent). As described by Harvey, the plant, to begin with, consists of a single saccate oblong frond, two—three cms. long which at its base tapers into a short stalk ending in a small disc, by means of which the plant is fastened to the substratum. From this primary sac similar, often narrower and longer, secondary sacs are issued in all directions, and these are again ramified in the same way and so on

*) Berthold, G., Über die Vertheilung der Algen in Golf von Neapel etc., p. 526.

**) Rodriguez, J., Algas de las Baleares, p. 254.

(Fig. 381). At their base the sacs taper considerebly to an almost acute point, while their summits are broadly rounded. The sacs are nearly cylindrical, sometimes somewhat flattened.

The wall is rather thin. It consists of a single layer of large cells which, above their transverse walls, are covered by a layer of cortical cells (Fig. 381 *E*). These are largest just over the transverse walls of the large cells growing smaller from here, leaving the middle of the large cells uncovered. Seen from above this arrangement gives the membrane a very fine, reticular appearance.

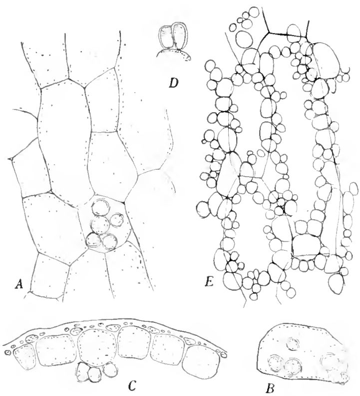

Fig.381. *Chrysymenia Enteromorpha* Harv. *A*, wall-cells facing the cavity, the one near the middle with a group of glands (70:1); *B*, a cell with glands (70:1); *C*, transverse section of the wall, one of the cells with glands (70:1); *D*, glands (70:1); *E*, part of the wall seen from above (compare the text) (125:1).

A transverse section shows the wall-cells to be roundish-rectangular (Fig. 381 *C*); seen from above they are irregularly polygonal or oblong, two—three times as long as they are broad (Fig. 381, *A*).

On the innerside facing the cavity one of the large cells bears now and then glands (Fig. 381 *A*, *C*). These are obovate-oval to pyriform, when seen from the side, and of rather variable size. They occur scattered or in small groups upon the surface of the mother-cell (Fig. 381 *B*). A number of ten or more can be found upon the same cell.

At the constrictions between the sacs there is a tissue consisting in the middle of very large cells covered by smaller ones (Fig. 382 a). From the large cells some small ones forming shorter chains protrude into the cavity of the vesicles. In the upper end of these cell-chains glands sometimes are found. Similar short chains of cells have been observed by Kuckuck in *Chrysymenia microphysa*.

Plants with tetraspores did not occur in my material. But

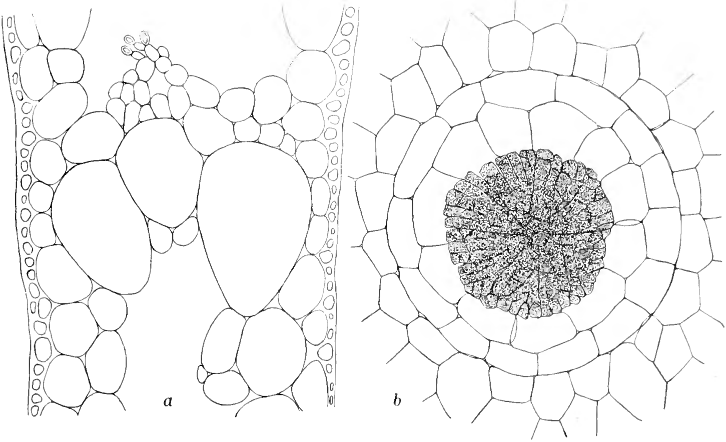

Fig. 382. *Chrysymenia Enteromorpha* Harv.
a, transverse section of the constriction between the sacs (about 80:1); *b*, a cystocarp seen from above (about 80:1).

in the "Phycotheca Bor.-Am.", No. 386, a tetrasporic specimen from Key West is found. The tetraspores are scattered over the whole surface of the thallus in the cortical layer and are cruciately divided.

Of a female plant a fragment only was gathered. The cystocarps are scattered over the surface of the thallus; they are hemispherical prominent and provided with an apical porus. Fig. 383 shows a longitudinal section through the middle of a nearly ripened cystocarp; in the middle the placental branch is seen from which the gonimoblasts are formed. Seen from above the cystocarps form spherical bodies (Fig. 382 *b*).

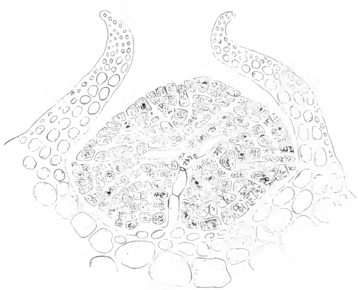

Fig. 383. *Chrysymenia Enteromorpha* Harv. Longitudinal section through the middle of a cystocarp (about 70:1).

This plant was dredged

in deep water (about 12—15 fathoms). Cystocarps were found in the month of March.

St. Jan: Off Cruz Bay, off America Hill.
Geogr. Distrib.: Key West.

5. Chrysymenia pyriformis Børgs.

F. Børgesen, W. I. Florideæ, II, p. 187 (Botanisk Tidsskr. vol. 30, 1910, p. 187).

The plant (Fig. 384) reaches a height of about $4^1/_2$ cm (the largest specimen collected, the smaller ones were about two cm only). It is fastened to the substratum, stones, shells etc., by means of a rather large, flat disc; from this disc, one or more, erect shoots grow up. The stem of these erect shoots is terete and solid. It bears the swollen, hollow and short shoots (Fig. 385). The shape of these is obovate-pyriform reaching a length of about 8 mm and a breadth of 5 mm.

Fig. 384. *Chrysymenia pyriformis* Børgs. About natural size.

The plant is, when living, somewhat translucent. The colour is red with a yellow-brown tinge. With the exception of the stem, which is firmer, it is of a rather soft and slimy consistency and adheres strongly to the paper.

As to the anatomy of the thallus, we find the wall of the vesicles consisting of a layer of large cells (Fig. 386 *A*) which on their outer side are covered more or less completely by a layer of small cells (Fig. 386 *B*). Seen from the surface the innermost large cells show themselves to be roundish polygonal (Fig. 386 *B*, *C*). Above the transverse walls of the large cells, where some more space is left on account of the somewhat curved surface of these cells, we find a row of roundish cells and from these again smaller and smaller roundish cells grow horizontally out over the surface of the large wall-cells (Fig. 386 *B*). In younger vesicles

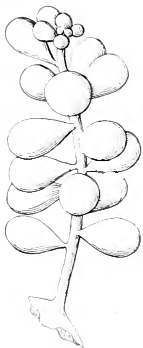

Fig. 385. *Chrysymenia pyriformis* Borgs. A little magnified (about $1^{1}/_{4}:1$).

this cortical layer leaves a space free over the middle of the large cells, while in older vesicles the cortical cells very often cover them completely. The wall of the vesicles is about 90 μ thick. The cavity in the interior is filled with mucilage.

A transverse section of the solid stem (Fig. 387) shows great likeness to that of *Chrysymenia microphysa* Hauck as drawn by Kuckuck (l. c., p. 210). The cells are largest in the middle, decreasing gradually towards the periphery.

On the inner side of the large cells, facing the cavity in the interior of the vesicles, we find here and there groups of gland-cells (Fig. 386 *A*, *C*). These are pear-shaped, occurring from two to about eight together in a bunch. Sometimes, too, a solitary gland-cell is present. The cells bearing the gland-cells are mostly smaller than the surrounding cells.

Only sterile plants have been gathered.

Compared with *Chrysymenia microphysa* Hauck — of which we have a detailed description since I described this species by the late Prof. Kuckuck — our plant differs essentially by its larger size, larger and differently shaped vesicles of which the Mediterranean plant mostly bears but a single terminal one upon each stem. Furthermore, glands are not found in the Mediterranean plant. Of the hitherto known *Chrysymenia*-species in the West Indian waters this plant comes, as I have already

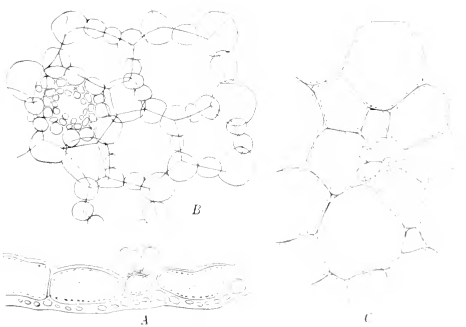

Fig. 386. *Chrysymenia pyriformis* Borgs. *A*, transverse section of the wall, in the middle a cell with glands (70:1). *B*, part of the wall seen from the surface (70:1). *C*, large cells of the wall facing the cavity, one of the cells with glands (70:1).

pointed out, nearest to *Chrysymenia Uvaria.* But among other characters, e. g. the small size of the thallus in comparison with that of *Chr. Uvaria*, it is easily distinguished from this species by the pear-shaped vesicles, in *Chr. Uvaria* nearly spherical, and by the fact that the vesicles are larger in *Chr. pyriformis.* In the anatomical characters also, for instance in the shape and occurrence of the glands, a great difference may be seen when comparing the descriptions and figures of both species.

This species was dredged in deep water only, at about 15—16 fathoms.

Found in the sea to the north of St. Jan: off. America Hill west of Thatch Island.

Geogr. Distrib.: Found at the Bermuda Isles by COLLINS.

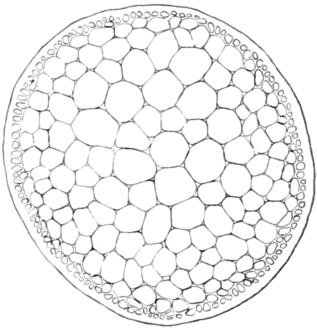

Fig. 387.
Chrysymenia pyriformis Borgs.
Transverse section of the stem.
(About 65:1)

6. Chrysymenia Uvaria (L.) J. Ag.

J. AGARDH, Algæ maris Mediterranei et Adriatici, p. 106; Epicrisis, p. 324; Florideernes Morphologi, tab. XVI, figs. 20—22. HARVEY, Nereis Bor.-Americana, Part II, p. 191, pl. XX, B, figs. 1—3. BØRGESEN, F., W. I. Florideæ, II, p. 189. KUCKUCK, P., Untersuchungen über Chrysymenia (Beitr. z. Kentn. d. Meeresalgen, 13, p. 214, pl. 13, figs. 14—15).

Fucus Uvarius L., Syst. Nat., 1767, II, p. 714.

Gastroclonium uvaria Kütz., Spec. Alg., p. 865; Tab. Phycol., vol. XV, tab. 97.

As pointed out by KUCKUCK, the West Indian plants attain a much larger size than those found in the Mediterranean Sea. Several of my specimens reach a height of up to 20 cms. The American specimens are proportionally more slender than those from the Mediterranean Sea, and the distance between the vesicles is mostly larger.

As to the anatomy, the wall of the vesicles consists inwardly towards the cavity of larger cells, and of smaller outwardly (Fig. 388 *A*). The cortical layer is dense (Fig. 388 *C*); covering the underlying large cells completely. The large cells are, when

seen from above, polygonal (Fig. 388 *B*), in transverse section roundish-oblong.

Towards the cavity in the interior of the vesicles the large cells (about a third part of them) bear here and there gland-cells, which are rather regularly distributed (Fig. 388 *B*). They are nearly always solitary, a single one in the middle of each cell; a few times I have found two, but distinct glands, upon the same cell. The glands are nearly spherical. According to KUCKUCK the glands do not occur in the Mediterranean plants or are at any rate very rare.

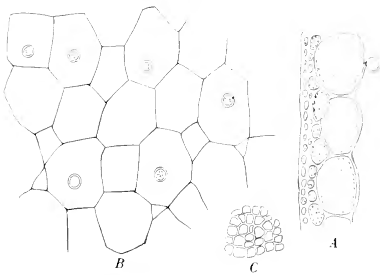

Fig. 388. *Chrysymenia Uvaria* (L.) J. Ag. *A*, transverse section of the wall, the uppermost of the large cells facing the cavity with a gland (70:1); *B*, large cells, facing the cavity, some of these with glands (70:1); *C*, part of the cortical layer seen from above (150:1).

In a specimen from Ajaccio, Corsica, which I gathered there in November 1897, I found glands rather abundantly; they were larger than those of the West Indian form, of oval to oblong shape, and occurred singly, but mostly quite near the cross-walls of the large cells.

Transverse sections and longitudinal sections of the massive stem of the West Indian plant seem quite to agree with KUCKUCK's description.

The above mentioned differences, regarding not only the external appearance of both plants but also their anatomy, show that the American plant does not exactly agree with the Mediterranean. I propose to call the American plant var. *occidentalis*, the differences between them not being of such importance that a specific distinction seems necessary.

All my material was sterile, but KUCKUCK gives fine illustrations of a part of a tetrasporic plant and of a transverse section of a cystocarp.

At the islands the plant was found in deep water only, at a depth of about 12—15 fathoms, while in the Mediterranean sea it is also found in shallow water.

St. Jan: In the sound between this island and St. Thomas and in the sea to the north of this island.

Geogr. Distrib.: West Indies, Morocco, Mediterranean Sea, Canary Islands.

Coelarthrum Børgs.

1. Coelarthrum Albertisii (Piccone) Børgs.

Børgesen, F., some new or little known West Indian Florideæ, II (Bot. Tidsskr., vol. 30, p. 189, 1910).

Chylocladia Albertisii Piccone, Crociera del "Corsaro" alle Isole Madera e Canarie del Capitano Enrico d'Albertis, p. 37, tab., fig. 3—5, 1884.

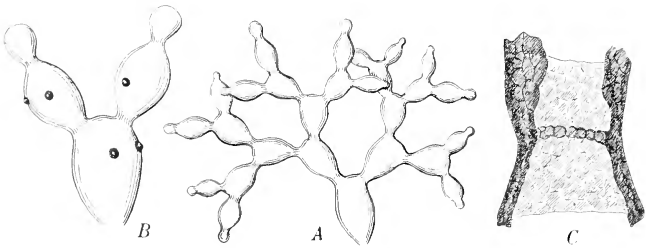

Fig. 389. *Coelarthrum Albertisii* (Piccone) Børgs.
A, part of a plant (about natural size); *B*, part of a female plant (about 2:1); *C*, transverse section showing the diaphragm between the joints (10:1).

As mentioned in my former paper this plant was at first found at the Canary Isles by Piccone and described by him as *Chylocladia Albertisii*. Referring to my above quoted paper with regard to my reasons for considering this plant a representative of a new genus, I shall here restrict myself to a short description of the plant.

Coelarthrum Albertisii forms small bushes about 4—5 cm high. The thallus is nearly terete, articulate, hollow, repeatedly dichotomously ramified (Fig. 389 *A*). The joints are largest in the basal part, in my specimens oblong obovate of shape, about 1 cm long and 1/2 cm broad; upwards the joints become gradually smaller and nearly spherical. Between the joints diaphragms are present dividing the cavity in the interior into as many compartments as there are joints (Fig. 389 *C*, 390 *A*).

The membrane consists of a layer of rather large cells oblong—rectangular when seen from the surface (Fig. 390 *D*, *E*), more roundish-quadrangular in transverse section (Fig. 390 *A*, *B*, *C*.)

Towards the surface these cells are covered by a cortical layer, this consists of oval—roundish cells forming a more or less dense cover. Above the cross-walls of the cells, where these,

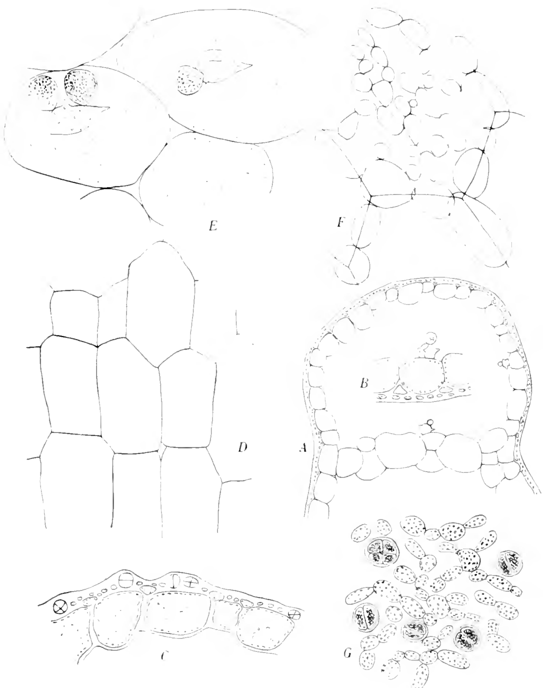

Fig. 390. *Coelarthrum Albertisii* (Piccone) Borgs.
A, transverse section of a joint at the apex of the thallus (about 10:1); *B*, *C*, transverse sections of the wall, *B* with a gland, *C* with tetraspores (70:1); *D*, large cells of the wall seen from the inner side (70:1); *E*, do. with glands (150:1); *F*, the wall seen from the surface showing also the underlying cells (150:1); *G*, part of the cortical layer with tetraspores (150 :1).

because of their roundish shape, leave some space open, some larger cells are found (Fig. 390 *F*) and from these larger cells smaller ones are given off growing out over the surface of the large wall-cells.

The diaphragms consist of a single or two layers of cells ac-

cording to the dimensions of the cells. Here and there, towards the cavity in the interior of the thallus, some of the cells in the membrane and diaphragms bear some smaller, irregularly stellate cells provided with shorter or longer prolongations (Figs. 390 *A*, *B*, *C*). Some of the prolongations of these cells are connected with the adjacent cell as seen in Fig. 391.

Upon the stellate cells one or, more rarely two nearly globular or short pyriform glands occur (Figs. 390 *E*, 391).

I have found only tetrasporic plants. The tetrasporangia

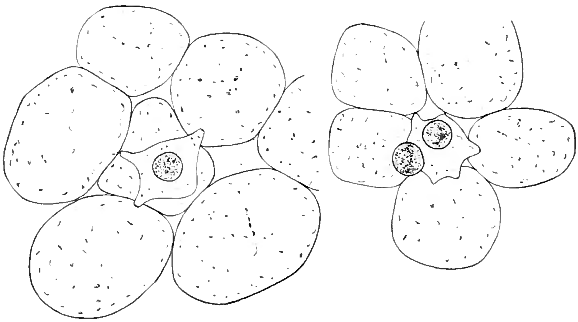

Fig. 391. *Coelarthrum Albertisii* (Piccone) Borgs.
Membrane-cells from the inner side with stellate cells and glands.
(About 275:1).

are formed in the cortical layer and are cruciately divided (Fig. 390 *G*). Their diameter reaches a length of about 25 μ. The tetrasporic plants were gathered in the month of March.

The cystocarps occur, according to a specimen from Guadeloupe collected by Schramm, scattered over the thallus (Fig. 389 *B*); they are hemispherically prominent and provided with a small apical porus.

At the islands this plant has been dredged only once in the sea to the north of St. Jan: off America Hill west of Tortola. I discovered it in a collection of several living algæ which Dr. Th. Mortensen, visiting the islands for zoological investigation, most kindly sent to me. It was dredged in deep water (about 15 fathoms) in rather open sea.

Geogr. Distrib.: Canary Islands, Guadeloupe, Bermuda.

Champia Desv.

1. **Champia parvula** (Ag.) Harv.

Harvey, W. H., Nereis Bor.-Am., part II, p. 76. J. Agardh, Epicrisis, p. 303. Farlow, W. G., The marine Algæ of New England, p. 156, pl. XV, figs. 2—5. De-Toni, G. B., Il genere Champia Desv. (Memorie d. Pont. Accad. del Nuovi Lincei, vol. XVII, Roma 1900, p. 11).

Chondria parvula Ag., Systema, p. 207.

Gastridium parvulum Grev., Alg. Brit., p. 119.

Chylocladia parvula Hook., Brit. Flora, II, p. 298. Harvey, Phycolog. Brit., tab. 210.

Lomentaria parvula Kütz., Spec. alg. p. 864; Tab. Phycol., vol. XV, tab. 87; J. Agardh, Spec. Alg. II, p. 729.

Fucus kaliformis, γ *nanus* Turner, Fuci, p. 61.

For more synonyms compare De-Toni, Sylloge Alg., vol. IV, part II, p. 558.

Many investigators have been engaged upon the examination of this plant; I mention below the chief authors and their papers.

Berthold[1]) in his useful treatise has given some short notes on this alga, but Debray[2]) and Bigelow[3]) were the first to give a more detailed description of the structure of it. Their papers were worked out quite independently of each other at about the same time. A few years later, in 1890, Debray published a "2me Mémoire", Sur la structure et le développement des Chylocladia, Champia et Lomentaria[4]) in which he amplifies his former paper. Later on Davis[5]) has given a detailed description of the development of the frond of *Champia* from the carpospore, and in the same year Hauptfleisch[6]) gives, besides a short description of the vegetative structure of

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1) Berthold, G., Beiträge zur Morphologie und Physiologie der Meeresalgen. (Jahrb. für wissensch. Botanik, Bd. 13, 1882, p. 686).

2) Debray, F., Recherch. sur la structure et le développement du thalle des Chylocladia, Champia et Lomentaria (Bullet. scient. départem. du Nord, 2° série, No. 718, Paris).

3) Bigelow, R. P., On the structure of the frond in Champia parvula Harv. (Proceed. Amer. Acad. of Arts & Sciences, 1887, p. 111).

4) In Bulletin Scientifique de la France et de la Belgique, tome 22, 1890).

5) Davis, B. M., Development of the frond of Champia parvula, Harv. from the carpospore (Annals of Botany, vol. 6, 1892, p. 339).

6) Hauptfleisch, P., Die Fruchtentwickelung der Gattungen Chylocladia, Champia und Lomentaria (Flora, vol. 75, 1892, p. 307).

the plant, a description of the development of the cystocarp. And finally, in 1896, Davis[1]) published a paper in which he gives a very detailed description of the development of the cystocarp in *Champia parvula.*

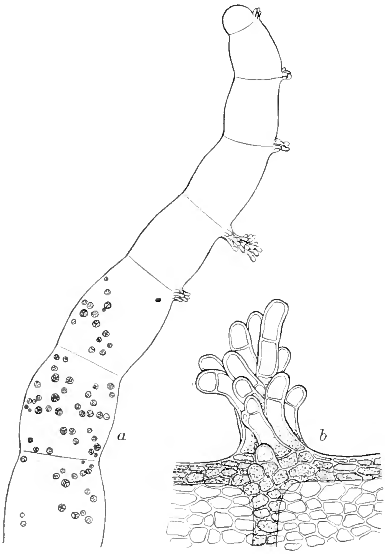

Fig. 392. *Champia parvula* (Ag.) Harv. *a*, part of a creeping filament with rhizoids and tetrasporangia (about 22:1); *b*, one of the bundle of rhizoids more magnified (about 60:1)

Referring to these examinations with regard to the structure and development of the plant, I shall only mention here that I have often found the plant creeping on the leaves of *Thalassia* as well as on larger algæ, for instance, *Udotea Flabellum* or *Halimeda.* The filaments are more or less decumbent and, from the nodes on that side of the filaments facing the hostplants, groups of surface cells grow out forming short hapters by means of which the plant attaches itself to the substratum (Fig. 392).

The tetraspores are formed in the peripheral layer in broad belts comprising several joints, generally rather close to the apex of branches (Fig. 392).

The antheridial stands (Fig. 393) form small roundish patches which often cover several coherent joints rather densely; sometimes the whole upper part of a branch is covered. Davis has l. c., 1896, pl. VII, fig. 1 figured a part of a male plant in which these often large zones of antheridial stands are seen.

A few young female plant have also been found; the cysto-

[1]) Davis, B. M., Development of the cystocarp of Champia parvula (Bot. Gazette, vol. 21, 1896, p. 109).

carps occur scattered, solitary or a few together upon the same joint. DAVIS has l. c. described their development.

This plant was found with tetraspores in the months January to March and with antheridia and cystocarps once in February.

It occurred in shallow water both in sheltered and in more exposed localities and in deep water down to a depth of about 20 fathoms. In deep water and in sheltered localities, for instance in lagoons, the plant is slender and the joints rather long, in more exposed places it is more robust with short joints.

St. Croix: Christianssted's Lagoon, Christianssted's Harbour, off Frederikssted, Krause's Lagoon. St. Jan: Off America Hill, off Ramshead.

Geogr. Distrib.: Warmer parts of the North-atlantic European and American coasts, Mediterranean Sea.

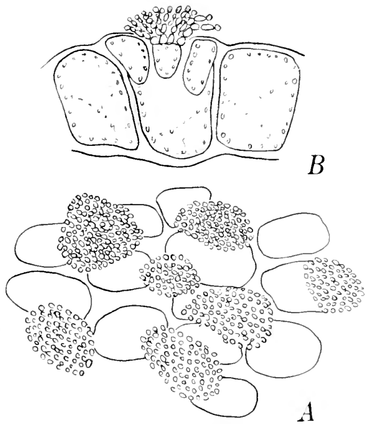

Fig. 393. *Champia parvula* (Ag.) Harv. *A*, part of the wall seen from above and *B*, transverse section of the wall of a male plant (350:1).

2. Champia salicornoides Harvey.

HARVEY, W. H., Nereis Bor.-Am., p. 76, tab. XIX B. AGARDH, J., Epicrisis, p. 305.

This species bears a rather close resemblance to *Champia parvula* not only with regard to its outer habit, but also in its anatomy. BIGELOW has pointed this out in his paper quoted above on p. 118. But *Champia salicornoides* is a much bigger plant and when examined more thoroughly, some anatomical differences also become apparent.

The peripheral wall of the frond consists of a single layer of cells, seen from above rectangular—polygonal, about $1^1/_2$ to 2 times as long as broad; in transverse section the cells are nearly square-shaped. The cells have a rather thick peripheral wall which swells greatly in water. The diaphragms between the joints of the thallus consists of a single layer of cells of irregular, polygonal

shape when seen from above (Fig. 394 *A*), more rectangular in transverse section (Fig. 394 *B*).

On the inner side of the wall we find the vertical filaments (Fig. 394 *B*, *D*). These are often in quite close connection with the wall-cells, sometimes even somewhat immersed in their thick membrane (Fig. 394 *C*). The filaments run from the apex of the branches to the bottom and pass through the diaphragms (Fig. 394 *A*, *B*). The cells of the filaments are about 16 μ thick and

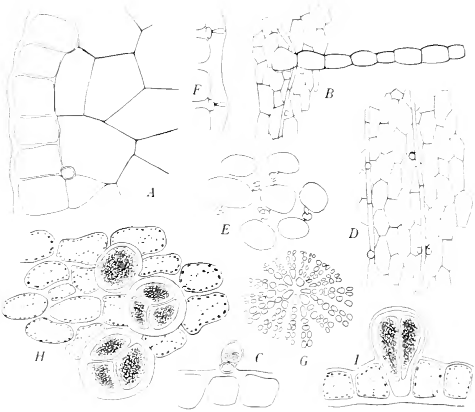

Fig. 394. *Champia salicornoides* Harv.
A, transverse section of the wall (to the left), to the right part of the diaphragm seen from above (50:1); *B*, transverse section of the diaphragm, to the left with a part of the wall (30:1); *C*, transverse section of the wall and a filament with a gland (50:1); *D*, the wall seen from the inner side with filaments (30:1); *E*, wall-cells with glands seen from above (150:1); *F*, part of the same in transverse section (150:1); *G*, apex of a branch seen from above (150:1); *H*, part of the wall with tetraspores (50:1); *I*, tetraspore in transverse section (50:1).

about ten times as long. They bear one, or sometimes, two opposite gland-cells placed about the middle of the cell. The glands are nearly spherical or somewhat ovate (Fig. 394 *C*). As a rule the filaments are not ramified, but once a side-branch was found connecting the filament with one of the adjacent filaments.

Among the larger wall-cells some smaller ones, rather regularly distributed, are generally present (Fig. 394 *E*); like the large cells the small ones, too, are connected by means of pores with the

adjacent cells. These small cells are mostly rather flat and from their upper (outer) side a small oblong cell merges vertically into the thick peripheral wall (Fig. 394 *F*). These cells are formed very early together with the other large cells and are already observable in the quite young parts of the thallus, and they are easily recognizable by means of their homogenous and more refractive contents. When treated with Chlor-Zinc-Iodine they are coloured yellow like the large wall cells and treated with Hæmatoxylin they assume also nearly the same tinge of colour as these. Most probably, as I have already pointed out in my above quoted paper, we have to do with a kind of gland-cells from which is secreted the mucilage in which the living plant, as far as I remember, is mostly imbedded.

The apical growth of the plant seems to agree fairly well with that of *Champia parvula* as described by Bigelow.

As I have pointed out already in my paper mentioned above I cannot agree with Bigelow when he says that "the branches in *Champia salicornoides* do not come off at the nodes, but may spring from any part of the internodes"; in my specimens the branches always issue at the diaphragms.

The tetrasporangia are formed in the wall in the following manner. A small cell is cut off now and then from one of the larger cells. This becomes to a great extent filled with contents and gradually increasing in size becomes the mother cell of the tetrasporangium. The tetrasporangia occur scattered over the whole surface of the branches; a transverse section shows that more than half their length emerges into the cavity of the joints.

The cystocarps are rather prominent, urn-shaped and occur scattered over the surface of the thallus.

Among the dried specimens a single male plant was found. The antheridial stands are very like those in *Champia parvula* and occur over the whole surface of the plant.

Farlow and later on De-Toni in his paper: "Il genere Champia Desv." have considered this species only as a variety of *Champia parvula.* As mentioned above *Champia salicornoides* certainly is closely related to *Champia parvula.* But *Champia salicornoides* is a much larger plant, and the arrangement of the tetrasporangia is not the same and some anatomical differences are also present, for instance there are several more vertical filaments in this

species than in *Champia parvula*, and the filaments have more cells in each joint than in *Ch. parvula.*

Plants with tetraspores and cystocarps were found in the month of March; antheridia in January. It was gathered mostly in deep water (about 14—15 fathoms), once in shallow water near the shore in a rather protected place.

Found at St. Jan. in several places in the sound between this island and St. Thomas, near Mary Bluff (by Dr. Th. Mortensen), off America Hill, Coral Bay.

Geogr. Distrib.: Florida.

List of the *Chlorophyceæ*, *Phæophyceæ* and *Rhodophyceæ* found at the islands together with addenda and corrections.

Chlorophyceæ.

1. **Enteromorpha flexuosa** (Wulf.) J. Ag.
2. — **chætomorphoides** Borgs.
3. — **lingulata** J. Ag.
4. — **plumosa** Kütz.
5. — **clathrata** (Roth) Greville.
6. **Ulva Lactuca** L.
7. — **fasciata** Delile.
8. **Blastophysa rhizopus** Rke.

Besides the plant I previously found growing in *Nemalion Schrammi* I have now found it, once more, rather abundantly in *Dictyota indica*, where it occurred in the epidermal cell-layer together with *Phæophila Floridearum* and *Endoderma.*

Seen from above the cells are oval to oblong, but still many of them are of a very irregular shape (Fig. 395 *a*). The cells contain a great number af roundish or polygonal chromatophores, a pyrenoid being present in the middle of some of those. The cells are about 100 μ long and 50 μ broad.

Sometimes the cells lie quite closely together, sometimes with some distance between, being then connected with a shorter or longer tube (comp. Fig. 395 *a*, *b*); this is about 8—10 μ thick.

The hairs occur upon the external side of the cells in groups of about two to six; the hairs are about 3 μ thick.

Fig. 395 *c*, *d* shows tranverse sections of the epidermal cell-layer of *Dictyota* in between which the *Blastophysa* is seen immersed;

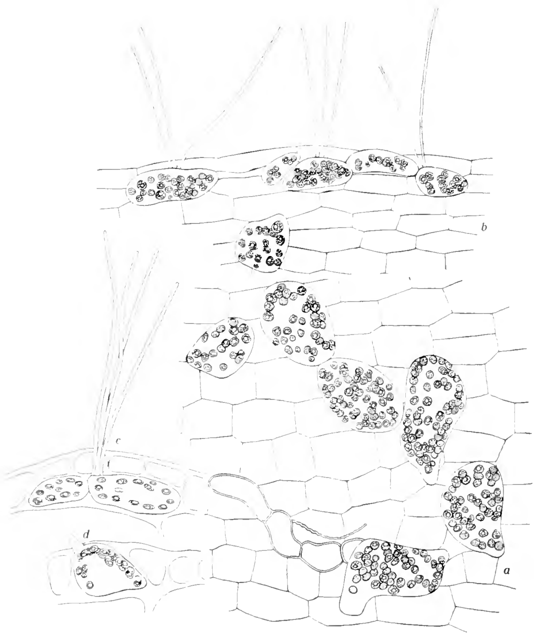

Fig. 395. *Blastophysa rhizopus* Rke.
a, seen from above. *b*, plant from near the margin of *Dictyota*.
c and *d*, transverse sections.
(About 200 : 1).

in the one figure two cells are seen lying below the epidermal cells of the *Dictyota*, in the other figure a single thicker cell is seen between the cells of the *Dictyota*.

The *Dictyota* was dredged in a depht of about 10 meters.

St. Croix: off Frederikssted.

9. **Phæophila Floridearum** Hauck.

Hauck, F., Verzeichnis der im Golfe von Triest gesammelten Meeresalgen (Oesterr. bot. Zeitschr., 1876, pp. 56,7). Huber, I., Contributions à la connaissance des Chaetophorées épiphytes et endophytes (Ann. sc. nat., 7. sér., bot., t. 16, p. 326, pl. XVI).

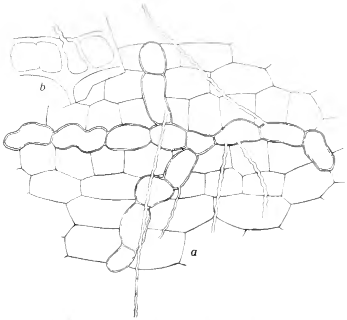

Fig. 396. *Phæophila Floridearum* Hauck. *a*, seen from above. *b*, transverse section. (About 200:1).

This plant has been found several times as an endophyte in different *Florideæ*, for instance in *Liagora pinnata*, *Laurencia Poitei*, *Griffithsia globifera* and *Champia parvula*.

Furthermore I have found this plant growing in the epidermal layer of *Dictyota indica* (Fig. 396). The cells reached a length of about 50 μ and a breadth of about 25 μ. The hairs are about 4 μ thick. The figure shows partly a piece of the plant together with the epidermal cell-layer of the host, partly a transverse section of the *Phæophila* immersed in the epidermal layer of the *Dictyota*.

St. Croix: off Frederikssted, Long Point, near Buck Island.

Geogr. Distrib.: Mediterranean Sea, Atlantic coast of Europe.

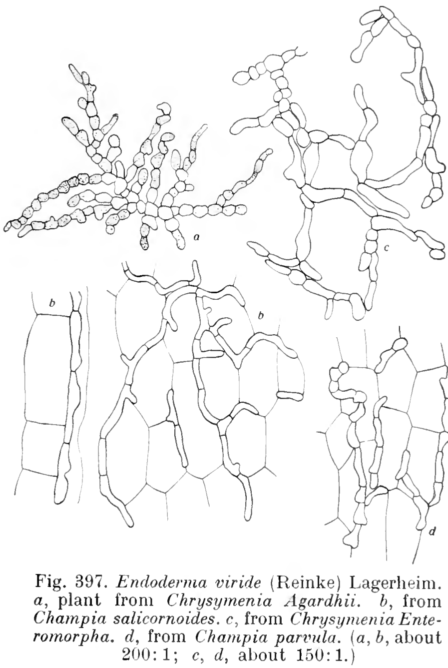

Fig. 397. *Endoderma viride* (Reinke) Lagerheim. *a*, plant from *Chrysymenia Agardhii*. *b*, from *Champia salicornoides*. *c*, from *Chrysymenia Enteromorpha*. *d*, from *Champia parvula*. (*a*, *b*, about 200:1; *c*, *d*, about 150:1.)

10. **Endoderma viride** (Reinke) Lagerh.

Once more I have found this plant upon *Chrysymenia Agardhii.* Several of the specimens had zoospores, a smaller or larger part of the cells in the middle of the plant being emptied. The Fig. 397 *a* shows such a plant. It was gathered in the month of January, and the host plant was dredged in deep water about 30 meter, at St. Jan: off America Hill.

In several other plants I have found forms of *Endoderma* which I think are referable to this species, even if they mutually show differences both as to the shape of the cells and as to their way of growing in the various host plants.

In a specimen of *Champia salicornoides* an *Endoderma* was found of which the Fig. 397 *b* shows a small piece. As is seen from the figure it forms a network composed of the jointed branching filaments which follow the outlines of the large wall cells of the host plant in a way very similar to that found in forma *Nitophylli* COTTON[1]). If we compare COTTON's figure 1 with my figure the likeness seems very striking. The diameter of the cells is about 3—6, the thickest cells reaching a breadth of up to 10 μ. The cells were crammed with starch, and the shape of the chromatophore was not recognizable. This plant was dredged in deep water about 15 fathoms in the Sound between St. Jan and St. Thomas: near Great St. James.

A very similar form was found in *Champia parvula.* Fig. 397 d shows a small piece of this *Endoderma.* The cells are a little shorter here, but the breadth of the cells are nearly the same as in the case of the form found in *Champia salicornoides.* It was dredged off Frederikssted, St. Croix, in a depth of about 10 meters.

In the epidermis of *Chrysymenia Enteromorpha* an other form (Fig. 397 *c*) was found which I think also can be referred to *End. viride.* It grows in a way similar to that of the above mentioned form following the outlines of the large membrane cells. It is a somewhat larger plant, its cells being from 6 to 14 μ broad. The shape of the cells is more irregular than in the former plant. In many of the cells the formation of zoospores was present and several cells were emptied of their contents. It was dredged off Cruz Bay, St. Jan, in a depth of about 12 fathoms.

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[1]) COTTON, A. D., On some endophytic Algæ (Journ. of the Linnean Soc., Bot., vol. 37. 1906, p. 288, pl. 12).

Further, in the thick membrane of *Hypnea cornuta* an *Endoderma* occurred whose cells were subcylindrical or sometimes more irregular with small elevations. As large cells are not present in the cortical layer of the *Hypnea* the endophyte creeps everywhere at random, forming an irregular network by means of its filaments which are ramified on both sides. The cells were about 5—7 μ thick and up to 40 μ long. The *Hypnea* was found in the harbour of Charlotte Amalia, St. Thomas.

Fig. 398. *Endoderma viride* (Rke.) Lagerh. from the epidermis of *Dictyota indica*. (About 175:1.)

Furthermore an *Endoderma* (Fig. 398) was found in the epidermis of *Dictyota indica*. It is freely dendritically ramified with branches issuing from both sides of the filaments and spreading widely in the host, following mostly the way above the vertical walls of its peripheral cells. The cells of this *Endoderma* have more or less sinuate walls and reach a length of up to 30 μ and a breadth of up to 15 μ. The cells are filled with granular contents, rich in starch. In the cells one or two pyrenoids are present. This form was dredged off Frederikssted, St. Croix in a depth of about 10 fathoms.

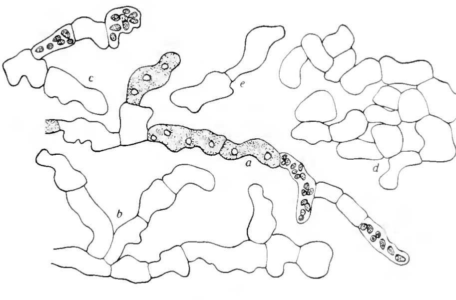

Fig. 399. *Endoderma viride* (Rke) Lagerh. Forma. Comp. text. (About 260:1.)

A very similar *Endoderma* was found in *Spyridia filamentosa* gathered at the shore of Green Cay Estate, St. Croix.

In an old *Caulerpa* another *Endoderma* was found of which the accompanying Fig. 399 shows some

filaments. As it is seen from the figure the irregularly branched filaments are composed of cells of rather varying shape. Near the apex of the filaments the cells are subcylindrical, but they soon obtain a very irregular shape often with several outgrowths and narrowings in between. In older parts of the plant the filaments are packed so closely together that they form an almost pseudoparenchymatous tissue (comp. Fig. 399 *d*). The cells are 8—11—14 μ sometimes up to 20 μ broad, and two to four times as long. They have a large parietal chromatophore with a few pyrenoids (1—3). All the cells may be transformed into zoosporangia. The zoospores escape by means of a hole in the cell-wall. I refer this *Endoderma*, as a forma *major*, to *E. viride*.

The *Caulerpa* was gathered in Christianssted's Lagoon, St. Croix.

11. **Endoderma vagans** nov. spec.

Thallus endophyticus, in membranis hospitis (*Griffithsiæ globiferæ*) valde circumvagabundus, e filamentis repentibus, articulatis, irregulariter ramosis compositus; cellulæ subcylindricæ, 5—13 μ latæ, diametro 2—4 plo vel ultro longiores, in media parte sæpe tumorem unilateralem vel rarius cellulam parvam gerentes; chromatophora parietalia, pyrenoideis pluribus instructa.

Zoosporæ numerosæ in cellulis vegetativis ortæ.

In the thick peripheral membrane of *Griffithsia globifera* a highly ramified *Endoderma* was found which I consider the representative of a new species (Fig. 400). In the specimen of *Griffithsia*, in which it was discovered, it was found in abundance and formed a reticular plate all round the cell of the host. In dried material the *Endoderma* had a clear green colour. Its cells are of very varying dimensions from 5 to 13 μ thick or more, and from 18 to more than 50 μ long. The shape of the cells is much varying, too; in most cases the cells are nearly cylindrical, or they may have an elevation on the one side, more seldom two opposite, one on each side. From this elevation a new branch frequently originates, but it may happen, that it is cut off by a wall, thus remaining as a small cell (Fig. 400 *a*).

The cells contain a large disc-formed chromatophore, covering nearly the whole lumen of the cell; in the chromatophore several pyrenoids (about 5—7) are present (Fig. 400 *c*, *d*). The

cells contain a great deal of starch and are coloured quite black by Iodine. A single nucleus is present in each cell.

In some of the cells zoospores were present (Fig. 400 *e*). The whole cell with its elevation is transformed into a sporangium. The zoospores are about 2 μ broad and 4 μ long with acute anterior end and broadly rounded dorsal end. They are formed in a number of about 15 in each cell, somewhat varying according to its size. The zoospores escape by means of a short channel

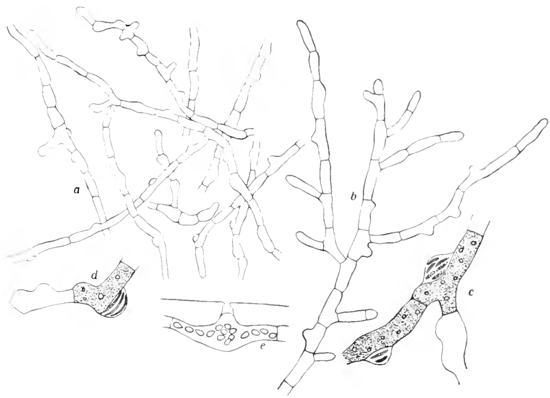

Fig. 400. *Endoderma vagans* nov. spec. Compare text. (*a*, about 150:1, *b* and *e*, about 250:1, *c* and *d*, about 500:1.)

through the membrane of the host plant which is formed by the elevation of the cell. The cilia were not visible.

There is still to be added that now and then the contents of the small cells mentioned above were divided into several small narrow bodies lying above each other up to a number of 5—6 or more (Fig. 400 *c* and *d*). They were filled with starch, becoming very dark when coloured by Iodine. What their function was I cannot tell, having not been able to follow their development, for which purpose living material is necessary.

The *Griffithsia*, in which this plant occurred, was dredged in a depth of about five fathoms in the month of January.

St. Croix: Near Buck Island.

12. **Endoderma ventriculosum** nov. spec.

Endoderma endophyticum in membranis hospitis (*Chrysymeniæ Agardhii*) maculas largas formans; thallus e filamentis articulatis, longis, irregulariter subdistiche ramosis, undulatis compositus; rami angulo fere recto e filo materno oriuntur.

Cellulæ longæ, subcylindricæ, crassitudine variabili, in parte media inflatæ, 4—20 μ latæ, sæpe 70 μ longæ, chromatophorum parietalem, pyrenoideis instructum continentes. Sporangia non visa.

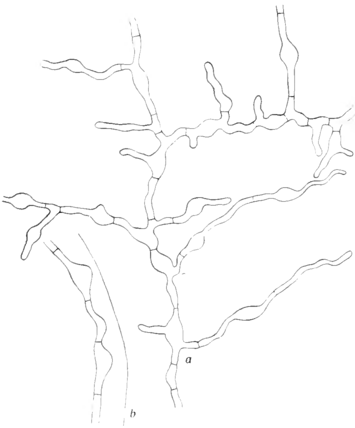

Fig. 401. *Endoderma ventriculosum* nov. spec. *a*, plant seen from above. *b*, transverse section through the host-plant with the endophyte. (*a*. about 150:1, *b*, 200:1.)

In the thick peripheral membrane of *Chrysymenia Agardhii* an endophytic, widely spreading plant (Fig. 401) of a very characteristic appearance was found, forming patches of great extensions in the host plant. This plant I think referable to the genus *Endoderma* as a new species.

In dried material the *Endoderma* was easily recognizable owing to its green coloured chromatophores, filling out the whole cell homogenuously. And, as to material preserved in alcohol, the plant in this case, too, when put into water and Iodine, was easily recognizable, the whole contents of the cells being coloured nearly black on account of the starch contained in the cells.

The plant consists of long cells of very irregular shape forming together highly ramified filaments. The apical cells are subcylindrical with obtuse summits and more or less undulated walls, but soon the cells swell in the middle, this swelling occupying nearly a third part of their whole length. Because of these swellings and, on the whole because of the very varying diameter of the cells, these being now thinner, now thicker and the undu-

lating shape of the cells, the filaments get a serpentine-like appearance.

The cylindrical part of the cells is about 4 μ thick, the swelled part often more than 20 μ. The cells reach a length of more than 70 μ.

The branches are mostly given off from the swelled parts of the cells, and it may happen that 3 to 4 branches issue from one and the same cell, this then becoming swelled and often very irregularly shaped through nearly its whole length. The ramification is rather irregular, but nevertheless a certain method is present, because a main filament is, as a rule, distinguishable, and from this branches are given off at about right angles on both sides. In this way the plant forms a reticular tissue with larger and smaller meshes all over the surface of the host.

The shape of the chromatophore was not to be seen with certainty in the material, but seems to be a parietal plate. There are several large pyrenoids in each cell; the cells contain much starch.

The *Chrysymenia*, in which it occurred, was dredged in about 15 fathoms of water.

St. Jan: off America Hill.

13. **Ulvella Lens** Crouan.
14. **Pringsheimia scutata** Reinke.
15. — (?) **Udoteæ** Børgs.
16. **Gomontia polyrhiza** (Lagerh.) Bornet et Flah.
17. **Chætomorpha clavata** (Ag.) Kütz.
18. — **antennina** (Bory) Kütz.
19. — **crassa** (Ag.) Kütz.
20. — **ærea** (Dillw.) Kütz.
21. — **brachygona** Harv.

Besides the above mentioned (vol. I, p. 18) detached form of this species I have found several fixed forms all characterized by proportionally short cells, but of rather varying diameter in the filaments; but, nevertheless, as it seems, closely connected. How far these forms are rightly referred to *Chætomorpha brachygona* I dare not say. A study upon living material of these forms, which in several respects bear a close resemblance to *Urospora*, would be highly interesting and instructive.

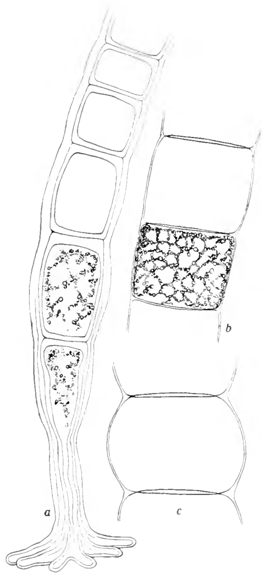

Fig. 402. *Chætomorpha brachygona* Harv. *a*, base of a plant. *b* and *c*, parts of the filament. (About 150:1.)

The figure 402 shows one of these forms. It is fixed to the rocks by means of a vigorous basal disc; the basal cell is long with thick and lamellated wall; it increases in size and is formed by the lowermost cells of the filament gradually growing downwards into the cell below, a well known fact described by ROSENVINGE[1]). The cells in the filament varies in length from about half their diameter to about as long as broad; they are rarely longer, but it happens that cells occur about twice as long as broad. In this specimen the upper end of the basal cell is 67 μ broad; the vegetative cell in the filament are about 85 μ broad and the emptied zoosporangia up to 150 μ broad. But I may point out that the breadth of the filaments is very varying, even in the same filament; for instance was a filament in some parts 45 μ thick only, in others 95 μ, and thinner and thicker parts were found in between each other.

Another form is shown in Fig 403 *a*, *b*, *c*. This has also a vigorous basal disc formed by the through growing of the lowermost cells. The cells in the vegetative part of the filament are nearly as long as broad, shortly

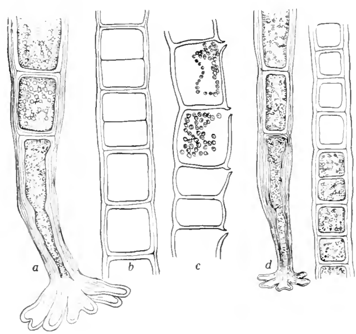

Fig. 403. *Chætomorpha brachygona* Harv. Two forms. Comp. text. (About 150:1.)

[1]) In »Botanisk Tidsskrift«, vol. 18, p. 65, 1892—93.

after division only half their length. The zoosporangia, have nearly the same shape, though often a little swelled in the middle. In this form the upper end of the basal cell is about 40 μ broad; the vegetative part of the filaments is 65 μ broad, and the sporangia 70 μ broad.

Parts of a very similar form is figured in Fig. 403 *d*, *e*. The vegetative cells in this plant reached a breadth of about 50 μ.

Finally in Fig. 404 *a*, *b* and *c*, *d* two more narrow forms are figured. Their vegetative cells vary in thickness from 35—45 μ. With the exception of those quite close to the base the cells in these forms are very short, often reaching not half their breadth.

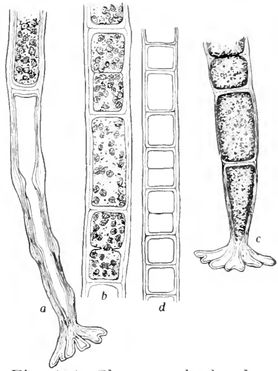

Fig. 404. *Chætomorpha brachygona* Harv. Two forms. Compare text. (About 200:1).

The specimens here described and figured are only to be considered as samples. Between them specimens may be found connecting them all gradually as to shape and size of the cells.

These forms were all growing together in an exposed locality and found in company with *Enteromorpha plumosa*, *Pylaiella fulvescens* and the below mentioned *Rhizocloniums*.

St. Jan: Christiansfort on steep rocks facing the open sea at about high water mark or a little above.

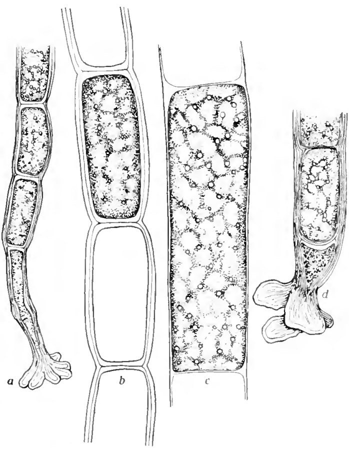

Fig. 405. *Chætomorpha gracilis* Kütz. *a*, *b*, *c*, parts of a filament. *d*, base of another plant. (About 150:1.)

22. Chætomorpha gracilis Kütz.

Besides the detached form mentioned in vol. I, p. 19 I have moreover found a fixed

form which I think referable to this species (Fig. 405). It was growing together with the above mentioned *Chætomorpha* forms.

It is fixed to the rocks etc. by means of a larger or shorter basal cell formed by throughgrowing of the lowermost cells. The cells in the vegetative part of the filaments are about 70—80 μ thick and two to four times as long. The zoosporangia are often a little swelled in their middle, about 85 μ thick and two to three times as long.

St. Jan: Christiansfort.

Rhizoclonium Kütz.

Upon steep rocks in an exposed place near high water mark or a little above some *Rhizoclonium* forms were found showing several peculiarities. They occured as parts of an interesting association of algæ, answering to the North-Atlantic *Bangia-Urospora* Association of the Færöes[1]) or the *Bangia-Urospora-Ulothrix* Association of Clare Island[2]). The members of the tropical association were: a small *Enteromorpha plumosa*, *Pylaiella fulvescens* and several species of *Chætomorpha* and *Rhizoclonium*.

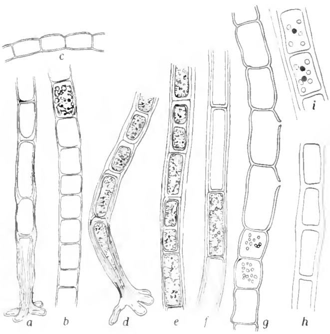

Fig. 406. *Rhizoclonium Kochianum* Kütz. Different forms with bases of two plants. (About 260:1.)

It is a well known fact that the genus *Rhizoclonium* is especially characterized by the presence of lateral rhizoids occurring more or less abundantly, though sometimes nearly or quite wanting, and by the absence of the original basal end-rhizoid, this having been found a few times only.

In the present forms (compare figs. 406 and 407) all the many specimens examined had no lateral rhizoids at all and in most

1) Börgesen, F., The Algæ-vegetation of the Færöese coasts (Botany of the Færöes, Part III, 1905, p. 719).

2) Cotton, A. D., Marine Algæ, Clare Island Survey 15, p. 30. (Proceedings Royal Irish Acad., vol. 31, 1912).

of the specimens the original basal rhizoids were present, the plants being fixed by means of them to the rocks. Most probably the end-rhizoid had been cut off during the gathering in the specimens in which it was absent.

The basal rhizoid (comp. Fig. 406 and 407) is below broadened out to a small disc with irregular coralliform outline, and the base on the whole becomes gradually strengthened by means of throughgrowing of the lowermost cells in the filament down into the basal cell in a way similar to that known so well in *Chætomorpha*. This throughgrowing can take place in three to four of the basal cells, the lowermost cell in this way becoming rather long.

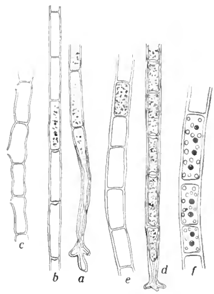

Fig. 407. *Rhizoclonium Kerneri* Stockm. Two forms with the original bases. (*a—e*, about 260:1; *f*. about 500:1.)

As already mentioned the original basal rhizoid in *Rhizoclonium* is very rarely found. Regarding *Rhizoclonium Kerneri* Stockm. WILLE in "Studien über Chlorophyceen", VII, p. 41 writes, as follows, concerning the basal rhizoid: »Beim Keimen der Zoosporen bildet sich ein basales Endrhizoid (Taf. IV, Fig. 166—68); aber da sich die Fäden durch intercalare Teilungen und zufällige Zerreissungen sehr stark vermehren, so findet man Fäden mit Endrhizoid sehr selten. Inwiefern die Fäden ursprünglich festsitzen, kann ich nicht mit Sicherheit ausmachen, vielleicht darf die eigentümliche starke Verdickung an dem abgebildeten Rhizoid (Taf. IV, Fig. 168) als eine abnorme Entwickelung gedeutet werden, indem sie keine Gelegenheit gehabt hatte sich zu befestigen, da dieses Exemplar nur loose zwichen den übrigen Fäden hing«. Regarding the presence of basal rhizoids in my specimens no doubt is possible. They were vigorously developed and present in all the specimens. As the plants have no other rhizoids to fix themselves with they would immediately have been washed away by the waves, if they had not been fixed by the basal rhizoids.

The filaments increase by means of intercalary divisions of the cells, these being divided when they have reached a certain length.

The cells contain a very irregularly shaped chromatophore of a reticular spongy appearance with smaller and larger openings. Often it fills up the whole lumen of the cell so densely that it is impossible to see its shape. In the chromatophores a large number of pyrenoids are present, distributed regularly in the cells. The cells contain, according to their size, one to four nuclei.

With Iodine and Chlor-Zinc-Iodine the chromatophores are coloured black showing that much starch is present. With the last mentioned chemical the walls of the cells do not show the cellulose reaction, the wall, just as when treated with Iodine alone, getting a light yellow tinge.

In the upper end of the filaments the cells gradually are transformed into zoosporangia; the zoospores escape through an opening in the wall of the cells. In accordance with the description of Wille this opening occurs a little above or below the middle of the cell, and the place, where it will come into existence, is beforehand marked by an outgrowth of the wall.

To point out any differences between these affixed forms of *Rhizoclonium*, as are described above, and *Chætomorpha* seems nearly impossible, and Stockmayer, too, has already mentioned this difficulty in his monograph of the genus *Rhizoclonium*, and that in spite of the fact that he did not know such forms fixed by the original end-rhizoid. Should I try to mention some differences between such forms of *Rhizoclonium*, as are mentioned above, and *Chætomorpha* I think the most essential differences are, besides the lesser dimension of the filaments, that the filaments of *Rhizoclonium* are mostly quite cylindrical, in *Chætomorpha* mostly moniliform, that the cells of *Rhizoclonium* are mostly proportionally longer and have thicker walls than those of *Chætomorpha*, that now and then in the filaments of *Rhizoclonium* a thickening of the wall is found round above the cross-wall between the cells (comp. Fig. 406 *h*) while in *Chætomorpha* the filaments are narrowed here. Characteristic of *Rhizoclonium* is also a kneelike bending (comp. Stockmayer, fig. 4, pag. 576) found now and then in the filaments. On the whole the appearance of a *Rhizoclonium* filament is rather like a *Conferva*, but the structure of the wall is quite different. Regarding the chromatophore its reticular structure is more easily seen in *Chætomorpha* than in *Rhizoclonium* in which the dense clumsy-spongy structure mostly makes it very indistinct.

The above mentioned non-colouring of the wall of *Rhizoclonium* with Chlor-Zinc-Iodine is of no use as a means of distinction, as the wall of *Chætomorpha*, too, does not show the common reaction of cellulose.

Finally I agree absolutely with STOCKMAYER when he recommends to study these plant upon living material.

Among the fixed forms I think the two forms mentioned below may be distinguished.

23. **Rhizoclonium Kochianum** Kütz.

Fig. 406 *a*, *b*, *c*, shows a form in which the cells are from nearly as long as broad up to $2^1/_2$ times as long; their diameter varies from 13 to 20 μ in length.

The zoosporangia are a little thicker, about 25 μ.

Another form is figured in Fig. 406 *d*, *e*, *f*, *g*. It is a little thicker than the above described plant, its vegetative cells reaching a breadth of about 20 μ, the length of the cells up to 62 μ. The zoosporangia are about 35 μ thick.

St. Jan: Christiansfort.

24. **Rhizoclonium Kerneri** Stockm.

Some other of the fixed forms I prefer to refer to this species which is characterized by its somewhat longer cells.

Fig. 407 *a*, *b*, *c* shows one form whose vegetative cells are about 10 μ thick and 40 μ long. It is fixed to the rocks by a long rhizoid formed by throughgrowing of three cells.

The zoosporangia are often a little narrowed in their middle, about 13 μ thick.

Another form with somewhat shorter cells is figured in Fig. 407 *d*, *e*. The vegetative cells are about 12 μ broad and two to four times as long.

St. Jan: Christiansfort.

25. **Cladophora uncinata** Børgs.
26. — **corallicola** Børgs.
27. — **fuliginosa** Kütz.
28. — **utriculosa** Kütz.

KÜTZING, Phycologia generalis, p. 269; Species Alg., p. 393; Tabulæ Phycologicæ, vol. 3, tab. 94, fig. 1. Hauck, Meeresalgen. p. 454.

A small tuft of this plant was found intermingled between several other algæ. The cells in the basal part were about 150 μ thick and up to ten times as long, upwards gradually shorter and thinner, the cells in the upper ramuli being only about 70 μ thick and a few times longer.

Found in shallow water, near the shore in a rather unprotected place.

St. Croix: Coakley Bay.

29. **Cladophora fascicularis** (Mert.) Kütz.
30. — **crispula** Vickers.
31. — **heteronema** (Ag.) Kütz.
32. **Anadyomene stellata** (Wulf.) Ag.
33. **Microdictyon umbilicatum** (Vell.) Zanard.
34. **Valonia ventricosa** J. Ag.
35. — **macrophysa** Kütz.
36. — **utricularis** (Roth) Ag.
37. — **Ægagropila** C. Ag.
38. **Dictyosphæria favulosa** (Ag.) Decsne.
39. — **van Bosseæ** Børgs.
40. **Cladophoropsis membranacea** (Ag.) Børgs.
41. **Boodlea Siamensis** Reinb.
42. **Struvea elegans** Børgs.
43. **Struvea anastomosans** (Harv.) Piccone.
44. **Chamædoris Peniculum** (Sol.) O. Kuntze.
45. **Siphonocladus tropicus** (Crouan) J. Ag.
46. **Ernodesmis verticillata** (Kütz.) Børgs.
47. **Neomeris annulata** Dickie.
48. **Batophora Oerstedi** J. Ag.
49. **Acetabularia Caliculus** Quoi et Gaimard.
50. — **crenulata** Lamx.
51. **Acicularia Schenckii** (Möb.) Solms.
52. **Avrainvillea nigricans** Decsne.
53. — **Mazei** Murray & Boodle.
54. — **Geppii** Børgs.
55. — **asarifolia** Børgs.
56. **Rhipilia tomentosa** Kütz
57. **Cladocephalus luteofuscus** (Crouan) Børgs.
58. **Penicillus capitatus** Lamarck.

forma *typica*.

— *laxa*.

59. **Penicillus Lamourouxii** Decaisne.
60. — **pyriformis** A. and E. S. Gepp.
forma *typica*.
— *explanata*.
61. — **dumetosus** Blainville.
62. **Udotea conglutinata** (Ell. et Sol.) Lamx.
63. — **cyathiformis** Decsne.
64. — **spinulosa** Howe.
65. — **occidentalis** A. and E. S. Gepp.
66. — **verticillosa** A. and E. S. Gepp.
67. — **Flabellum** (Ell. et Sol.) Howe.
68. **Halimeda Tuna** (Ell. et Sol.) Lamx.
— var. *typica* Barton.
— var. *platydisca* (Decsne) Barton.
69. — **discoidea** Decsne.
var. *typica* Børgs.

In the text p. 106 after the word *typica* a",' through misprint has fallen out. I regret the mistake having herewith seemingly referred this variety to Dr. Howe. Comp. Dr. Howe's remark regarding this matter in "Torreya", vol. 15, 1915 p. 48.

var. *platyloba* Børgs.
70. **Halimeda Opuntia** (L.) Lamx.
71. — **gracilis** Harv.
var. *opuntioides* Børgs.
72. — **incrassata** (Ell. et Sol.) Lamx.
var. *typica* Barton.
f. *gracilis* Børgs.
var. *monilis* (Ell. et Sol.) Barton.
f. *robusta* Børgs.
f. *cylindrica* Børgs.
var. *simulans* (Howe) Børgs.
73. **Codium difforme** Kütz.
74. — **tomentosum** (Huds.) Stackh.
75. — **isthmocladum** Vickers.
76. — **elongatum** C. Ag.
77. **Bryopsis Duchassaingii** J. Ag.

78. **Bryopsis plumosa** (Huds.) Ag.
var. *pennata* (Lamx.).
var. *secunda* Harv.
var. *Leprieurii* (Kütz.).

79. **Caulerpa fastigiata** Mont.

Besides the locality mentioned above this plant has been found among several other algæ on the reef between the Hurricane Island and St. Thomas.

80. **Caulerpa Vickersiæ** Børgs.

Being dedicated to the late M[lle] *Vickers* the specific name for this plant ought to be *Vickersiæ* and not *Vickersii.*

81. **Caulerpa verticillata** J. Ag.
f. *typica* Børgs.
f. *charoides* (Harv.) Web. v. Bosse.

82. — **Webbiana** Mont.
f. *disticha* Web. v. Bosse.

83. — **prolifera** (Forsk.) Lamx.
f. *obovata* J. Ag.
f. *zosterifolia* Børgs.

84. — **crassifolia** (Ag.) J. Ag.
f. *typica* (Web. v. Bosse) Børgs.
f. *mexicana* (Sonder) J. Ag.

85. — **taxifolia** (Vahl) Ag.

86. — **sertularioides** (Gmel.) Howe.
f. *typica* Børgs.
f. *brevipes* (J. Ag.) Svedelius.
f. *longiseta* (J. Ag.) Svedelius.
f. *Farlowii* (Web. v. Bosse) Børgs.

87. — **Ashmeadi** Harv.

88. — **cupressoides** (Vahl) Ag., Web. v. Bosse emend.
var. *mamillosa* (Mont.) Web. v. Bosse.
var. *typica* Web. v. Bosse.
var. *plumarioides* Børgs.
var. *flabellata* Børgs.
var. *elegans* (Crouan) Web. v. Bosse.

89. — **racemosa** (Forsk.) Web. v. Bosse.
var. *clavifera* (Turner) Web. v. Bosse.
f. *reducta* Børgs.

var. *uvifera* (Turner) J. Ag.
var. *occidentalis* (J. Ag.) Børgs.
var. *lætevirens* (Mont.) Web. v. Bosse.
var. *Lamourouxii* (Turner) Web. v. Bosse.

90. **Vaucheria dichotoma** (L.) Ag.

Phæophyceæ.

Pylaiella (Bory) Kjellmann.

Subgen. **Bachelotia** Bornet.

1. **Pylaiella fulvescens** (Schousb.) Bornet.

Bornet, Ed., Note sur l'Ectocarpus (Pylaiella) fulvescens Thuret (Revue générale bot., tome 1, 1889, p. 5, pl. 1); Les Algues de P.-K.-A. Schousboe (Mémoires ... Cherbourg, t. XXVIII, 1892, p. 247). Sauvageau, C., Note sur l'Ectocarpus (Pylaiella) fulvescens Thuret (Journ. de Botanique, 1896, p. 47).

Conferva fulvescens Schousboe mscr.; Icon. ined., t. 115 in Herb. Thuret.

Ectocarpus fulvescens Thuret in Algæ Schousb. no's 109—110.

This peculiar plant has been found twice in two different collections intermingled with other algæ.

As is well known from Bornet's and, more recently, from Sauvageau's descriptions of this plant it has creeping filaments fixed to the rocks by short haptera; from these creeping filaments the erect ones arise. In the material gathered I have found small fragments of the creeping filaments, but an abundance of the erect filaments, these having been cut over when collected. In most of the erect filaments an intercalary growing zone was found in about their middle. In this zone the cells are dark coloured, the chromatophores filling up nearly the whole lumen of the cells; these are all short being divided as soon as they reach a length corresponding to their breadth or even earlier.

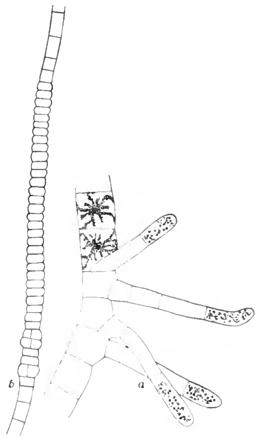

Fig. 408. *Pylaiella fulvescens* (Schousb.) Bornet. *a*, part of a filament with rhizoids. *b*, part of a filament with sporangia. *a*, about 150:1; *b*, 70:1.)

From this growing zone the cells gradually increase in length towards both ends. The filaments are about 35 μ thick and the cells reach a length of up to 90 μ. The peripheral walls are about 2 μ thick.

In some of the filaments rhizoid-like short branchlets were found (408 *a*). These seem to be able to grow out from all vegetative cells; in one filament, for instance, they were growing out from both ends of the filament. Another filament was much curved in the one end and from nearly all the cells here short branchlets were issued from the convex side of the filament. According to

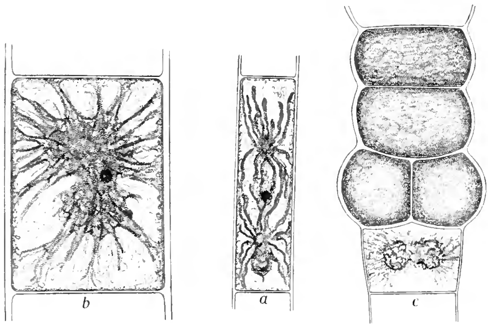

Fig. 409. *Pylaiella fulvescens* (Schousb.) Bornet.
a, *b*, cells with chloroplasts and nuclei. *c*, parts of a fertile filament. (About 350:1.)

Sauvageau this takes place in the upper ends of the erect filaments, these by means of these branchlets, »crampons« becoming often fixed also in the upper end. The branchlets may attain to a considerable length; they have more or less sinuate walls. They are about 16 μ thick, their cells being about four times longer than broad.

The cells contain a beautiful and very characteristic chromatophore, closely reminding of the one in *Zygnema* (Figs. 408 *a*, 409). The chromatophore is stellate; from a dense centre long, thin prolongations protrude in all directions towards the wall of the cells, here often being broadened out to small roundish or oval discs lying closely against the wall. Two stars of chromatophore are present in each cell; in the longer cells the distance

between the two chromatophores is often rather considerable these being connected by a broader or slender strand of protoplasm. In the shorter cells the chromatophores gradually approach forming apparently in the young and newly divided cells but a single stellate chromatophore.

As pointed out by SAUVAGEAU, too, the comparatively small nucleus is found in the strand of protoplasm between the two chromatophores (comp. Fig. 409 *a*, *b*.)

In one of the filaments nearly ripe sporangia were present. The sporangia have thick walls (Fig. 409 *c*); they are somewhat broader than the vegetative cells, about 50 μ broad, but often not half as long, about 20 μ. In the upper end a few of the cells were divided into two sporangia each. In the fertile filament found, 35 sporangia were present in the row (Fig. 408 *g*).

None of the sporangia present were ripe or emptied, but the disposition of the very large zoospores, characteristic of this plant, was clearly seen.

According to the above description the West Indian plant seems in all essentials to agree with the one from Morocco and the South of France, described by BORNET and SAUVAGEAU.

It was found with sporangia in the month of March.

It was once gathered on rocks near the surface of the sea between other small algæ, e. g. *Chætomorpha*, *Enteromorpha* and *Myxophyceæ* in a rather exposed place where the waves constantly dash the rocks. Another time it was found in a more protected, lagoon-like locality intermingled with a tuft of *Hypnea cervicornis*.

St. Thomas: near Charlotte Amalia in the Harbour. St. Jan: Cruz Bay.

Geogr. Distrib.: Morocco, south of France and Spain.

2. **Ectocarpus Duchassaingianus** Grun.
3. — **Mitchellæ** Harv.
4. — **coniferus** Børgs.
5. — **Rallsiæ** Vickers.

6. — **rhodochortonoides** Børgs.

In the diagnosis p. 170 the diameter of the filaments is, on account of a misprint, stated to be 21 μ; it is 11 μ as is found in the text, p. 171, but this length of the diameter is found only

in the basal part of the filaments and in the more vigorous ones, higher up in the filaments and in the less vigorous the diameter descreases to about 7 μ.

The chromatophores are not very developed; each consists of a few irregularly bent and ramified narrow ribbons in each cells.

7. **Ectocarpus variabilis** Vickers.

VICKERS, A., Liste des algues de la Barbade (Ann. sc. nat. Bot., sér., 9, t. 5, 1905, p. 59); Phycol. Barbadensis, pl. XXXI.

Upon some old leaves of *Thalassia testudinum* a small creeping *Ectocarpus* was found forming small low tufts upon it. This plant I think referable to the above mentioned species of the late Mlle. VICKERS. In one respect, to be sure namely the length of the cells, it differed somewhat from her figure in which the cells are drawn very short, mostly not twice their breadth, but in the diagnosis of the species the length is said to be three times the breadth which agrees better with my plant.

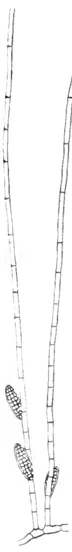

Fig. 410. *Ectocarpus variabliis* Vickers. (About 250:1.)

The plant, of which a piece is shown in Fig. 410, has creeping basal filaments from which the erect ones arise. These have a diameter of about 9—12 μ in their lower part decreasing gradually upwards to about 7 μ. In the lower part the cells are about 22—30—40 μ long, higher up they become slowly longer, in the upper ends of the filaments reaching a length of more than 60 μ. The upper ends are not hairlike, the apical cells have roundish summit, ending now and then in a sporangium.

A marked growing zone is not found.

In each cell several irregularly bent, narrow ribbon-like, chromatophores are present.

The plurilocular sporangia are sessile or pedicellate, of rather variable size and shape, lanceolate to oblong with broadly rounded summit; about 60 μ long and 27 μ broad.

The plant was found in a lagoon-like locality in the harbour of St. Thomas.

Geogr. Distrib.: Barbadoes.

8. **Ectocarpus breviarticulatus** J. Ag.

9. — **elachistæformis** Heydr.

Of this plant I have come across some more material, and I am able to make some additions to my former description, vol. I, p. 174.

In its basal part not only horizontal filaments are present, as shown in Fig. 137 *a*, but also more or less vertical short ones (Fig. 411 *a*). These are growing down in the tissue of the host. They are mostly rather thick, about 20 μ thick and composed of short cells in which chromatophores are present.

The upper cells of the assimilating filaments are often nearly colourless, but their summits are mostly obtuse. The uppermost cells reach a length of about 70 μ.

Upon the assimilating filaments from near their base and rather high up, short plurilocular sporangia occurred (411 *b*). These are mostly short, proportionally thick and sessile, they are about 12 μ broad and 25—35 up to 70 μ long.

The common plurilocular sporangia, found at the base of the plant, often reached a length of more than 170 μ.

In one plant a supposed unilocular sporangium was found (Fig. 411 *b*). It was ovate of shape, placed terminally upon a short stalk composed of short cells. The sporangium was 50 μ long and 28 μ broad; the cells in the stalk 11 μ broad.

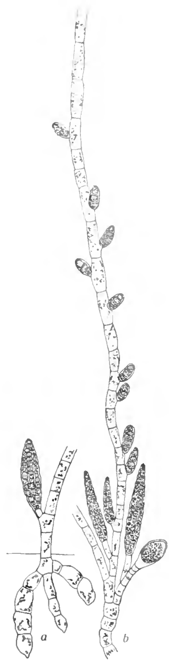

Fig. 411.
Ectocarpus elachistæformis Heydr. *a*, part of the base of a plant. *b*, part of plant with unilocular sporangium and plurilocular sporangia up along the assimilating filament.
(*a*, about 200:1; *b*, 150:1.)

Ascocyclus Magnus.

10. **Ascocyclus Hypneæ** nov. spec.

Fila basalia endophytica inter cellulas externas hospitis, *Hypneæ musciformis*, repentia, ex cellulis brevibus composita;

hæc pilos, ascocystos et sporangia erecta extra hospitem surgentia gignunt.

Ascocysti clavati, ca. 65 μ longi et 10—16 μ lati. Pili longi; articuli eorum in parte basali breves, ca. 6 μ lati, in superiori parte longi, ca. 180 μ et crassiores, ca. 16 μ lati. Sporangia pluri-locularia ex pediculis brevibus surgentia, oblonga-fusiformia, ca. 16—26 μ lata et 65 μ longa.

Upon a specimen of *Hypnea musciformis* a small, partly en-dophytic brown alga was found which I think can be referred to the genus *Ascocyclus*, having those bodies, named ascocysts by *Sauvageau* (Myrionemaceæ, p. 9), characteristic of the genus.

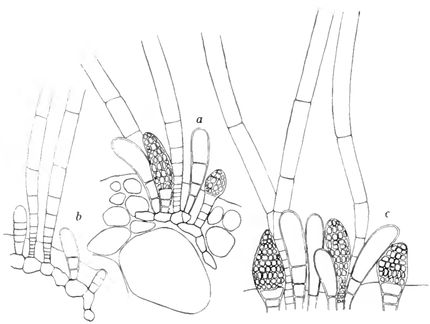

Fig. 412. *Ascocyclus Hypneæ* nov. spec. *a*, *b*, *c*, parts of the plant. (About 150:1.)

The base of the plant (Fig. 412 *a*, *b*) consists of filaments creeping among the peripheral cells of the *Hypnea*. The cells in these filaments are rather irregularly shaped, often swollen in their middle. They reach a breadth of about 7—8 μ. From these cells arise: 1) the ascocysts, 2) the hairs and 3) the sporangia. Characteristic for all three organs is that they are rather thin at their start from the creeping filaments, but gradually, as they approach the periphery of the host plant, they become thicker (comp. Fig. 412).

The ascocysts are clavate in shape; from a slender base they increase gradually upwards until near their apices which are broadly rounded. They are about 65 μ long and their diameter reaches a length of about 10—16 μ. They may arise directly from a cell in the creeping filament or have a few short cells at their base. They have thick walls and their contents seem rather homogenuous and of a dark brown colour in spite of the plant having been preserved in alcohol.

The hairs have a growth zone near their base; here the cells

are quite short and filled with chromatophores; higher up the cells gradually grow longer and become nearly destitute of chromatophores; in the upper parts of the hairs the cells reach a length of about 180 μ. In the basal part the hairs are thin, their diameter reaching a length of about 6 μ only; higher up the hairs grow thicker to about 16 μ. The cells of the hairs are barrel-shaped cylindrical, being a little narrowed at the cross-walls.

The plurilocular sporangia are oblong to spindleshaped, about 16—26 μ broad and 65 μ long. They have a short stalk consisting of a single or a few cells.

Owing to its partly endophytic way of growing and to the fact that the basal filaments do not form a disc this plant differs from the hitherto described species of this genus and ought perhaps rather to be referred to a new genus. Nevertheless I have preferred to refer it to the genus *Ascocyclus*, having not seen much of it.

The *Hypnea* upon which this plant was found was gathered in the month of January near the shore in shallow water.

St. Croix: Lime Tree Bay.

Fam. ***Myriotrichiaceæ.***

Myriotrichia Harv.

11. **Myriotrichia occidentalis** nov. spec.

Frons ex filis basalibus repentibus, ramosis et filis erectis composita.

Filamenta basalia ex cellulis, 20 μ longis et 10 μ latis composita, ramis aut oppositis aut alternis et unilateralibus instructa.

Ex cellulis basalibus aut pili, aut fila brevia, aut rarius sporangia plurilocularia aut filamenta principalia oriuntur.

Pili ca. 12 μ lati ex cellulis hyalinis valde elongatis orti.

Fila brevia, ca. 150 μ alta et 12 μ lata, ex cellulis ca. 6 composita, apice obtuso, rarius ramosa.

Fila principalia monosiphonia, ca. 1 mm longa, 18—24 μ lata; hæc ex cellulis sparsis (»nodis«) fila brevia, simplicia aut ramosa, opposite aut subverticillate orta gerunt.

Sporangia plurilocularia, aut sessilia aut pedicellata, 50—100 μ longa et 12—30 μ lata ex seriebus pluribus loculorum composita.

The plant (Fig. 413) forms small, low tufts upon the host plant, *Dictyota indica*, from which the longer main filaments protrude.

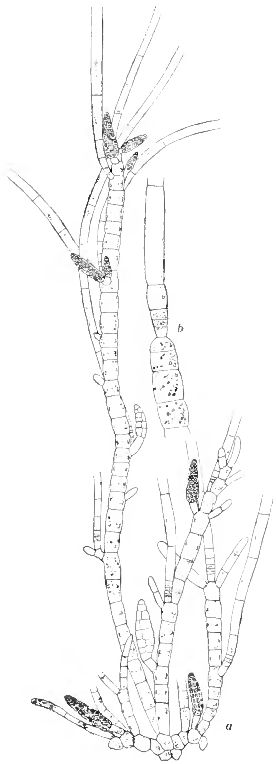

Fig. 413. *Myriotrichia occidentalis* nov. spec. *a* part of a, plant with sporangia (someones emptied). *b*, apex of a filament with terminal hair. (*a*. about 150:1; *b*, about 250:1.)

The base (Fig. 414 *a*) of the plant consists of freely ramified filaments creeping upon the surface of the host and fixed to it by means of quite short, small rhizoids (Fig. 414 *b*). The filaments have apical growth and the branches are given off from the distal end of the cells at both sides, now alternating, now opposite or sometimes, too, unilateral. The filaments are mutually free. The cells in the basal filaments contain well developed chromatophores; the cells are about 10 μ broad and 20 μ long.

From the cells of this base the different erect organs are given off, namely: short branchlets, hairs, long main filaments and more rarely plurilocular sporangia (comp. Fig. 413 *a* and 414 *a*, *b*). The short branchlets are commonly unbranched, nearly cylindrical with obtuse apex, composed of about six cells reaching a height of about 150 μ and a breadth of 12 μ, more rarely ramified.

The hairs have one or two basal cells of which the lowermost is the longest; above these cells the growth zone follows. Upwards in the hairs the cells rapidly increase in length, being very long in the upper end. The hairs are about 12 μ thick.

The few plurilocular sporangia found growing out from the basal filaments had, at their base, a single or a few sterile cells, about 8—9 μ broad. The sporangia are elongated-spindle-shaped, about 80 μ long and 20 μ broad.

Of the long main filaments I have found only a few; one of the longest, reaching a length of about 1 mm, is figured in Fig. 413. The breadth of the main filaments is about 18—24 μ; they are composed of cells of rather variable length from shorter than the length to about their double length. The filaments found by me have all been monosiphonous throughout, longitudinal walls being not present at all. But having seen so few erect filaments

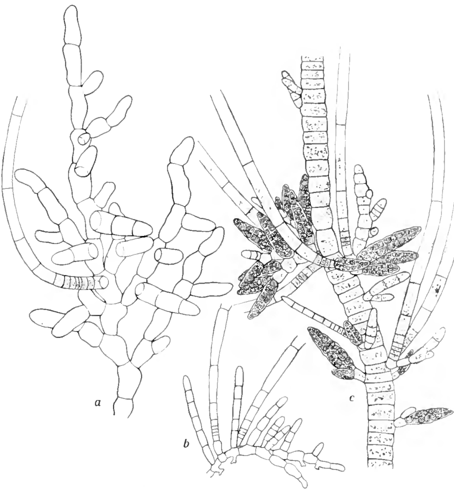

Fig. 414. *Myriotrichia occidentalis* nov. spec.
a and *b*, parts of the basal filaments seen from above and from the side. *c*, part of a main filament with hairs, branchlets and sporangia. (*a*, about 260:1. *b* and *c*, about 150:1.)

it is of course possible that such may occur in more developed specimens. As pointed out by Kuckuck[1]) the growth of the main filaments takes place by means of intercalary division of the cells (comp. Fig. 413 and 414 *c*), but this division is restricted mostly to the middle and upper end of the filaments. The top of the filaments end in a terminal hair (comp. Fig. 413 *b* and *a* the branch to the right).

The erect main filaments are provided with side-organs of

[1]) Kuckuck, P., Die Gattung Myriotrichia Harvey. Beiträge zur Kenntnis der Meeresalgen, 6, 1899, p. 59.

three kinds: short branchlets, hairs and sporangia. They are mostly arranged in a tier-like manner issuing several from the same cell, each tier being separated by a row of bare cells.

The branchlets are short, often spinelike, undivided or provided with hairs. Two opposite branchlets are mostly given off from each point. In the upper, more richly developed part of the erect shoots the branchlets grow larger, become ramified and bear often several plurilocular sporangia and hairs.

The hairs are like those issued from the basal filaments; they have a longer cell at their base, then the growing zone follows above which the cells quickly grow long and colourless. In the lower part of the erect shoots they are given off immediately from the main filament, higher up, as mentioned above, mostly from the branchlets.

The plurilocular sporangia are rarely sessile, mostly pedicellate or placed upon the branchlets. They are spindleshaped about 50—100 μ long and 12—20—30 μ broad.

Unilocular sporangia were not found.

Considering the species of *Myriotrichia* hitherto described this plant seems to be most closely related to *Myriotrichia repens*, this species having for the most part monosiphonous filaments, and the dimensions of the cells and the development of the erect filaments being rather like the West Indian plant. But the West Indian plant differs nevertheless essentially from *Myriotrichia repens* in the very different development of the basal filaments, and in the fact that the filaments, as far as hitherto found, always are monosiphonous, the knot-cells (Knoten of Kuckuck) being not even divided and in the development of the plurilocular sporangia, these having two or more rows of loculi in each.

Our plant seems to show some likeness, too, to the certainly very imperfectly known species *Myr. canariensis* Kütz., but this species has rather many longitudinal walls in the main filaments, and the plurilocular sporangia seem, according to Kützing's figure and as pointed out by Kuckuck, to be very like those found in *M. clavæformis*.

The *Dictyota indica* upon which this species was found was dredged in the month of February in the open sea at a depth of about ten meters.

St. Croix: off Frederikssted.

12. **Colpomenia sinuosa** (Roth) Derb. et Sol.

13. **Hydroclathrus cancellatus** Bory.

14. **Rosenvingea Sanctæ Crucis** Borgs.

In the description of this plant (vol. I, p. 178) the locality and occurrence has been omitted. It was found in shallow water near the shore in a sheltered place this being protected from the open sea by coral reefs. It was attached to small stones. It was gathered in the month of January.

St. Croix: Longford.

15. **Castagnea Zosteræ** (Mohr) Thur.

16. **Myrionema vulgare** Thur.

THURET, G., in Le Jolis, Liste des algues mar. de Cherbourg, p. 82. SAUVAGEAU, C., Sur quelques Myrionémacées (Ann. sc. nat., Bot., Sér. 8, Tome 5, 1897, p. 185).

Upon an old *Sargassum*, together with many other epiphytic and partly endophytic algæ, a *Myrionema* also occurred which I think referable to *M. vulgare*.

Fig. 415 *a* shows a part of the basal disc; it consists of creeping filaments whose cells are from 5 to 7 μ thick. And fig. 415 *b* shows plurilocular sporangia from the older parts of the plant; the sporangia are about 7 μ thick. The hairs have a rather long sheath at their base; they are about 7—8 μ thick.

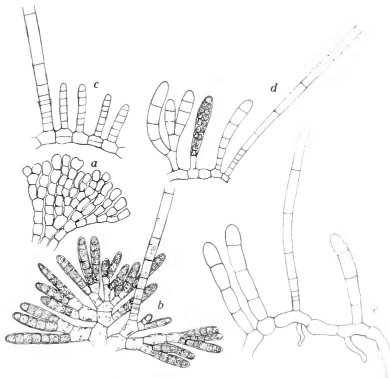

Fig. 415. *Myrionema vulgare* Thur. *a*, *b*, *c*, parts of a plant from St. Thomas. *d*, part of a plant from St. Croix. *e*, part of a plant from St. Jan. (*a*, *b*, *c*, *d*, about 275:1. *e*, about 200:1.)

This plant was found in the harbour of St. Thomas.

A very similar plant was found upon *Chætomorpha antennina* gathered at »Northside«, St. Croix in a very exposed place (Fig. 415 *d*).

Further upon an old *Dasya* a tuft of a somewhat more robust form was found (Fig. 415 *e*).

The base of this plant was very like the Fig. 2*A* of SAUVAGEAU, l. c., p. 31. The cells in the filament are about 8—10 μ thick.

Hairs occur rather abundantly; they have a growing zone at their base with a slightly developed sheath and are about 7—8 μ thick. The erect assimilating filaments consist of about 4 cells; their diameter reaches a length of about 11 μ. Of plurilocular sporangia only a few unripe have been found. This plant was dredged in about ten fathoms of water in the sound between St. Thomas and St. Jan: off Cruz Bay.

Geogr. Distrib.: The European and American shores of the Atlantic Ocean, Mediterranean Sea.

17. **Ralfsia expansa** J. Ag.
18. **Lithoderma** spec.
19. **Aglaozonia Canariensis** Sauvag.
20. **Sphacelaria tribuloides** Menegh.
21. — **furcigera** Kütz.
22. **Zonaria variegata** (Lamx.) Mert.
23. — **lobata** Ag.
24. **Padina Sanctæ Crucis** Børgs.
25. — **gymnospora** (Kütz.) Vickers.
26. — **Howeana** nov. nom.

Syn.: *Padina variegata* Hauck et auctores. HAUCK, F., Ueber einige von I. M. HILDEBRANDT im Rothen Meere und Indischen Ocean gesammelte Algen (Hedwigia, vol. 26, 1887, p. 41). VICKERS, A., Phycologia Barbadensis, part II, pl. VIII. BÖRGESEN, F., The marine Algæ of the Danish West Indies, vol. I, p. 205. COLLINS, FR. S. and HERVEY, A. B., The Algæ of Bermuda, v. 87.

Zonaria variegata Kütz., Tab. Phyc., vol. IX, pl. 73, fig. 2.

In a review of the parts of my paper dealing with the green and brown algæ Dr. HOWE[1]) points out that when both *Zonaria variegata* and *Padina variegata* are derived from LAMOUROUX'S *Dictyota variegata* this practice cannot be kept up according to the rules of nomenclature.

Dr. HOWE writes: »This practice, which did not originate with BÖRGESEN, seems to rest upon the assumption that the original *Dictyota variegata* of LAMOUROUX was a mixture of two

[1]) In »Torreya«, vol. 15, 1915, p. 46.

species, representing two genera of the same family, and that, in spite of the confusion entailed, this specific name was available and valid in each of these two related genera, — a practice that is possibly permissible under the »Vienna Rules« but is distinctly forbidden by the »American Code«. In this particular case, the present reviewer has enjoyed the privilege of seeing the specimens of *Dictyota variegata* Lamour. in LAMOUROUX's herbarium at Caen and finds that they agree with the figures published by LAMOUROUX in showing only a *Zonaria* (the *Gymnosorus variegatus* of J. AGARDH), so that the name »*Padina variegata* (Lamx.) Hauck«, employed by BÖRGESEN would seem to be vulnerable on the ground of historical fact as well as on the ground of nomenclature theory.«

To this I wish to remark that, when working out my paper, I had no access to the original specimens of LAMOUROUX, the examination of which was the necessary starting point for an eventual change of name for one of the plants in question, the figure of LAMOUROUX being such, that even if it shows perhaps most likeness to *Zonaria variegata* this, nevertheless, cannot be stated with absolute certainty. Therefore I followed the practice of HAUCK. But now, when Dr. HOWE has examined the original specimens of LAMOUROUX, the case is different. The plant, named *Padina variegata* uptill now, must be given a new specific name and in honour of Dr. HOWE, who has solved the question, I propose to call it *Padina Howeana.*

27. **Dictyota Bartayresiana** Lamx.
28. — **linearis** (Ag.) Grev.
29. — **volubilis** Kütz.
30. — **pardalis** Kütz.
31. — **Indica** Sonder.
32. — **ciliata** J. Ag.
33. — **crenulata** J. Ag.
34. — **dentata** Lamx.
35. **Dilophus alternans** J. Ag.
36. — **Guineensis** (Kütz.) J. Ag.
37. **Dictyopteris delicatula** Lamx.
38. — **plagiogramma** (Mont.) Vickers.
39. — **Justii** Lamx.

Dictyerpa Collins.

40. **Dictyerpa Jamaicensis** Collins.

Collins, F. S.; The algæ of Jamaica (Proceed. Americ. Acad. of Arts and Sciences, vol. 37, 1901, p. 251).

Some small specimens have been found which I think referable to this plant. They were collected in a rather exposed place upon the small reef near the entrance to the harbour of St. Thomas. They form small, low tufts, most probably growing in narrow crevices in the rocks over which the waves constantly dashed. They are fixed to the substratum by means of numerous rhizoids breaking out in groups everywhere on the thallus.

The thallus consists of thin slender filaments about 300 to 600 μ thick or more, which, in transverse section, are roundish or oval. The ramification is very irregular, being di, tri- to polychotomous. The internodes are of variable length; they are thinnest at their base and increase gradually upwards. The young group of rhizoids are covered by the cuticula forming an indusium which bursts later on. The rhizoids are about 27 μ thick, being divided into cells more than four times longer. They are irregularly bent and nearly destitute of contents.

The thallus increases by means of a large nearly hemispherical apical cell from which segments are cut off in all directions.

From a transverse section is seen that the thallus consists of a cortical layer of small, nearly quadrangular cells with considerable contents and a medullary layer of larger colourless cells being irregularly polygonal or often nearly rectangular; the walls of these cells are more or less undulated. A longitudinal section shows these cells to be about twice as long as broad.

Regeneration seems to take place very easily, I have several times seen a group of young branches grow out from the thallus when it has been broken.

As in the case of the plant from Jamaica this, too, was quite sterile.

Regarding this plant Svedelius in Engler u. Prantl, Nat. Pflanzenfam., Nachtr. zu 1. Theil, Abt. 2, p. 188 writes: Die Gattung *Dictyerpa* ist höchst wahrscheinlich nichts anderes als eine freiliegende, trotzdem aber weiterlebende Form einer normalerweise auf Steinen wachsenden *Dictyota*, die durch die

freiliegende Lebensweise ein Aussehen und einen cylindrischen Bau bekommen hat, ganz wie z. B. freiliegende kleine *Fucus*-Formen. Daraus erklärt sich auch ihre Sterilität«. Most probably SVEDELIUS is right in this supposition. To be sure my plant was not detached, but fixed to rocks. Nevertheless there is a possibility that we may have to do with a form, the development of which has been retarded because of unfortunate, external conditions of life. It might perhaps belong to *Padina*, the basal part of which in the young state is terete.

Found in crevices in the small reef near the entrance to the Harbour of St. Thomas.

Geogr. Distrib.: Jamaica.

41. **Turbinaria trialata** Kütz.
42. **Sargassum vulgare** C. Ag.
— var. *typica*.
— var. *foliosum* (Lamx.) J. Ag.
43. — **lendigerum** (L.) Kütz.
44. — **platycarpum** Mont.
45. — **Hystrix** J. Ag.[1]

Rhodophyceæ.

1. **Asterocytis ramosa** (Thwaites) Gobi.
2. **Goniotrichum elegans** (Chauv.) Le Jolis.
3. — **Humphreyi** Collins.

As already pointed out in a corrective note to the Part II, 1916, of the *Rhodophyceæ*, the plant which I, on p. 10, have referred to *Bangiopsis subsimplex* is not this plant, but a form of COLLINS'

[1]) *Sargassum natans* (L.) Meyen and *Sargassum fluitans* Borgs. both treated in length in my paper: "The Species of *Sargassum* found along the coasts of the Danish West Indies with remarks upon the floating forms of the Sargasso Sea" (Mindeskrift for JAPETUS STEENSTRUP, Kobenhavn 1914, No. 32), and the last species described in vol. I. of the present work p. 222, are both floating, pelagic forms, the most common species of the Sargasso Sea. Now and then both forms are washed ashore at the islands, but having never been found attached there, they do not belong to the flora of the islands and are therefo re not mentioned in the list.

Goniotrichum Humphreyi, described in COLLINS, HOLDEN and SETCHELL, Phycotheca Bor.-Am., No. 421 and in COLLINS, The Algæ of Jamaica (Proc. Amer. Acad., vol. 37, 1901, p. 251).

4. **Erythrotrichia carnea** (Dillw.) J. Ag.
5. **Erythrocladia subintegra** Rosenv.
6. **Acrochætium Sargassi** Borgs.
7. — **crassipes** Borgs.
8. — **pulchellum** Borgs.
9. — **netrocarpum** Borgs.
10. — **gracile** Borgs.

11. — **cæspitiforme** nov. spec.

Thallus parvus, gracillimus cæspitosus usque ad 700 μ altus in *Padina Howeana* epiphyticus. Pars basalis e filis repentibus plus minus lateraliter confluentibus composita. Cellulæ subbreves, 8 μ longæ et 5 μ latæ.

Fila erecta quoquoversum ramosa, ad apicem versus attenuata; ramis sparsis nonnumquam secundatis aut irregulariter ortis. Cellulis in inferiori parte filorum ca. 5 μ latis et 12 μ longis, in superiori ca. 2,5 μ latis; in ramis paulo minoribus, inferioribus 3—4 μ latis, superioribus ca. 2 μ latis.

Rami recti, sub angulis acutis surgentes; in inferiori parte eorum ramuli breves sporangia gerentes.

Sporangia pedicellata aut raro sessilia, 11—12 μ longa et 6 μ lata.

Chromatophorum parietale irregulariter lobatum aut perforatum pyrenoide laterali munitum.

Upon a young *Padina Howeana* an *Acrochætium* was found which I think must be regarded as a new species (Fig. 416). It comes, undoubtedly, in several respects rather near to the *Acr. gracile* described above on p. 26, but differs from this species in its ramification and in the deviating arrangement of the sporangia.

The plant forms small roundish tufts formed by the densely placed and very ramified filaments. It grows with preference along the edges of the *Padina* and the basal filaments run along it. The base (Fig. 416 *a*), in which the original spore is not visible, consists of filaments creeping upon the surface of the host. These filaments merge more or less together, forming an often large,

more or less coherent disc. The cells in the basal filaments are about 5 μ broad and 8 μ long.

From nearly all the cells of these filaments erect ones arise. These are ramified from rather near the base; the branches are given off in all directions, but very irregularly, often several above each other at the same side. And the distance between the branches, too, is very variable; in some cases a row of cells of the main filaments carry a branch, in other several bare cells are present between those bearing branches (Fig. 416 *b*). The branches are straight and given off at acute angles. The main filaments are at the base about 5 μ thick and the cells 12 μ long; upwards they taper slowly to about 2,5 μ. The branches are proportionally smaller, 3—4 μ at their base, about 2 μ at their summit.

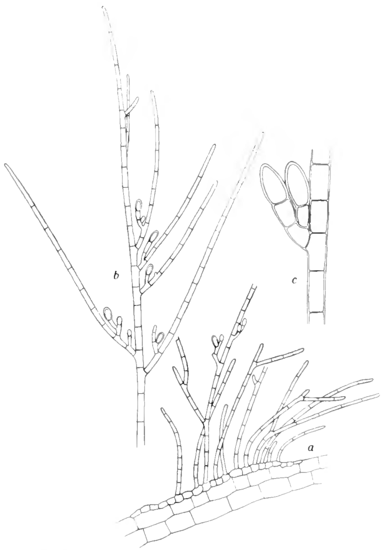

Fig. 416. *Acrochætium cæspitiforme* nov. spec. *a*, basal part of the plant. *b*, upper part of a filament. *c*, branchlet with sporangia. (*a*, about 200:1; *b*, about 260:1; *c*, about 600:1).

The sporangia are linear-oblong, 11—12 μ long and about 6 μ broad. They occur upon short branchlets at the base of the branches (Fig. 416 *b*, *c*). The sporangia are mostly pedicellate, rarely sessile. In the upper end of the main filaments these, too, carry branchlets with sporangia.

The chromatophore is an irregularly lobed or perforated, parietal plate, covering most of the cell and including a lateral pyrenoid.

The most important differences between this species and *Acr. gracile* are, that in *Acr. gracile* the erect filaments are very

slightly ramified or not at all, while in *Acrochætium cæspitiformis* the ramification is considerable; further, the sporangia in *Acr. gracile*, owing to the scanty ramification, are placed up along the main filaments, while in *Acr. cæspitiforme* they are found at the base of the branches.

The plant was gathered at the end of February in shallow water near the shore.

St. Croix: Salt River.

12. **Acrochætium globosum** Børgs.
13. — **Sancti Thomæ** Børgs.
14. — **seriatum** Børgs.
15. — **flexuosum** Vickers.

16. **Acrochætium** spec.

Upon a young *Padina Howeana* a few plants of an *Acrochætium* were found, showing apparently some likeness to *Acr. flexuosum*. Having had so little material of it at my disposal, I prefer to leave it unnamed.

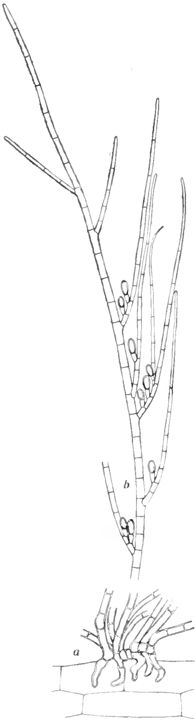

Fig. 417. *Acrochætium* spec. *a*, base of the plant. *b*, part of erect filament. (*a*, about 200:1; *b*, about 150:1).

It forms tufts up to more than one mm.; one specimens was about 1200 μ high.

The base consists of short, creeping filaments (Fig. 417 *a*); these are irregularly bent, in the middle of the basal layer interwoven and merging together, but with free ends. The cells in the basal filaments are about 8 μ thick and 11 μ long.

The erect filaments (Fig. 417 *b*) arising from the basal filaments are from 10—13 μ thick and the cells about 35 μ long. Upwards the main filaments do not taper much: until at about 8—11 μ.

The filaments are very ramified; from near the base they carry branches given off irregularly at all sides with longer and shorter rows of bare cells in between, and often with some tendency to secund arangement. The branches are given off at acute angles; they seremto be rather rigid and are a little curved. They are somewhat thinner than the main filaments, at their base about 9 μ, tapering to about 5 to 6 μ at their apex.

The chromatophore is a parietal plate with a large lateral pyrenoid, protruding far into the lumen of the cell.

The sporangia occur at the base of the branches; in the specimens found one, two, or, more rarely, three upon each branch, The sporangia are pedicellate or more rarely the uppermost sessile. The sporangia are oval in shape; they have a thick wall especially at their upper end. They are about 21 μ long and 13 μ broad.

From this plant *Acr. flexuosum* Vickers chiefly differs in its thinner filaments and by the presence of ramuli, upon which the sporangia are placed.

Our plant ought also to be compared with *Acr. Daviesii* (Dillw.) Nägl. showing in its short, thick-walled cells and whole ramification great likeness to this species. But it differs in an essential way especially by the lack of the repeatedly ramified branchlets.

The plant was gathered in shallow water at the end of February.

St. Croix: Salt River.

17. **Acrochætium unipes** Børgs.

18. — **opetigenum** Børgs.

19. **Acrochætium robustum** Børgs.

When I described this plant I had not come across young specimens. In fig. 418 the basal parts of two young plants are figured; in these the basal discs are not yet developed. From these figures it seems quite clear, that the germinating spore during its growth produces downwards the process which penetrates into the tissue of the host. The process has an acute base and thick walls. It is not separated from the original germinating spore by any wall. The process is the only endophytic part of the plant; the original spore and the small disc gradually developed round it are epiphytic.

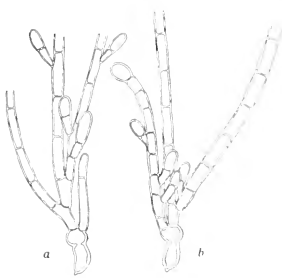

Fig. 418. *Acrochætium robustum* Børgs. Bases of two young plants. (About 250:1).

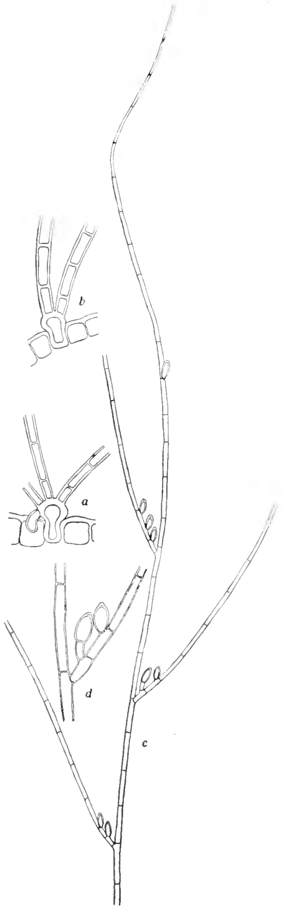

Fig. 419. *Acrochætium* spec. *a* and *b*, basal parts of plants. *c*, upper part of a filament. *d*, small part of the same, more magnified. (*a*, *b*, *d*, about 200:1; *c*, about 140:1).

20. **Acrochætium** spec.

HOWE anf HOYT[1]) in 1916 described an *Acrochætium affine* which is closely related to COLLINS' *Acr. Hoytii*, described in "Rhodora", 1908, p. 134 and to the two species *Acr. robustum* and *unipes* described by me. They made a thorough comparison between their new species and COLLINS' and my plants and arrived at the conclusion that: "there seems to be no compelling reason for the association of our plant with any one of the three names mentioned rather than with any other of the three."

Growing rather abundantly upon a *Dictyota*, which I have determined to be *Dictyota indica*, I have once more found an *Acrochætium* (Fig. 419) which is closely related to the above-mentioned species, but which, nevertheless, when more carefully examined, shows differences from all four species.

As is characteristic of these species the germinating spore of the plant now found produces a more or less obtuse process penetrating into the peripheral layer of the host, reaching a length of about 28 μ (Fig. 419 *a*, *b*); the spore itself remains lying upon the wall of the host; its diameter reaches a maximum of about 16 μ.

[1]) HOWE, M. A. and W. D. HOYT, Notes on some marine Algæ from the vicinity of Beaufort, North Carolina (Memoirs of the New York Bot. Garden, 6, 1916).

From the spore a few cells are gradually developed in all directions; by more or less growing together they form in older, vigorous plants a small disc. From the spore and from the surrounding cells erect filaments are given off. These are mostly not ramified near their base, higher up branches are given off in all directions.

At the base the filaments are 8—10—12 μ broad, tapering slowly upwards, the apices reaching a breadth of about 4—6 μ only. The filaments reach a height of about 3 mm. The cells contain a parietal, slightly developed chromatophore with a lateral pyrenoid protruding far into the cells. The chromatophore is mostly developed in the basal part of the plant, upwards less so. The branches are given off at acute angles in all direction from the main filaments which are for the most part easily observable; the branches are similar to the main filaments, thicker below, thinner upwards. At their base from the distal end of the lowermost cells the sporangia are issued (Fig. 419 *c*). These are sessile or pedicellate, in some specimens about half of all the sporangia are pedicellate. The sporangia have a little thickening of the wall in their upper end (Fig. 419 *d*). They are about 11—12 μ broad and 21 μ long. Other fructiferous organs were not found.

If we now compare this plant with the above-mentioned four related species and begin with *Acr. unipes* we find, that this species differs firstly by the fact that generally a single erect filament is issued from each spore; now and then an accessoric branch may be present, but this is no doubt mostly due to the fact that the primary branch has been damaged; comp. my fig. 33 *b*. The sporangia seem always to be sessile in *Acr. unipes*, and they are more scattered placed upon the branches; furthermore the sporangia are proportionally a little broader in *Acr. unipes*, namely about 12 μ broad and 20 μ long, and their apex is more obtuse with no such marked thickening above in the wall.

According to Howe's and Hoyt's description *Acr. affine* differs from our plant on account of the 1—4 erect filaments issuing from the primary basal cell, "often subdichotomous or subtrichotomous at the distal end of the first cell"; furthermore by the presence of terminal hairs. Cystocarps and antheridia were found in this plant.

And *Acr. robustum* differs from the above described form

by its much more robust habit, forming a dense tuft composed in older plants of many more filaments arising from the basal disc. The erect filaments are furthermore divided from near their base. The chromatophore is vigorously developed, forming irregularly shaped plates. The filaments are 7—10 μ thick, tapering very slightly from the base upwards, their upper ends being 5—6 μ thick with obtuse apices and with well developed chromatophores, even in the upper cells. The sporangia are smaller, about 9 μ broad and 15 μ long.

Finally *Acr. Hoytii*, according to the description by COLLINS and additional remarks by HOWE and HOYT, l. c., p. 119, differs from our plant by its, on the whole, smaller dimensions, by its differing ramification, — the erect filament being much ramified below, rarer above, — and by its smaller sporangia 6 × 15 μ.

The *Acrochætium* spec. was found at a depth of about ten meters.

St. Croix: off Frederikssted.

21. **Acrochætium bisporum** Børgs.
22. — **occidentale** Børgs.
23. — **comptum** Børgs.
24. — **Avrainvilleæ** Børgs.
25. — **hormorhizum** Børgs.
26. — **Hypneæ** Børgs.
27. — **repens** Børgs.

The host plant in which this species was found was *Hypnea musciformis*.

Creeping with its basal part in the thick membrane of *Griffithsia globifera* an *Acrochætium* was found which I prefer to consider as a form of this species, until more material can be examined.

The plant (Fig. 420) has long, irregularly ramified, endophytic filaments creeping throughout the thick membrane of the host (Fig. 420 *a*). Now and then from these basal filaments erect ones are given off. The cells of the basal filaments are subcylindrical to oval being thickest in their middle, the filaments by this getting a more or less moniliform appearance; the cells reach a breadth of up to 11 μ and are two to three times as long. They have a parietal chromatophore with a parietal pyrenoid. I have not

been able to discover the original germinating spore and the plant may therefore be referred to group III of Bornet[1]).

The erect filaments have at their base rather short cells; higher up these grow gradually longer, the filaments at the same time becoming thinner. At the base of the filaments the cells are about 8 μ, in their middle about 5 μ, the upper ends about 2 μ only. The cells contain a parietal chromatophore and a parietal pyrenoid; upwards in the filaments the chromatophore becomes less developed and is quite or nearly absent in the uppermost thin cells.

Fig. 420. *Acrochætium repens* Børgs. *a*, endophytic, basal filaments. *b*, erect filament with sporangia. (About 175:1).

The filaments are scantily ramified bearing short branches at all sides; just as in the case of the main axes of the erect filaments the main axes of the branches are thickest below with short cells, having longer and thin cells above.

Upon the lowermost cells of the branches the sporangia occur, placed mostly two together upon a short pedicel (Fig. 420 *b*). The sporangia are about 8 μ broad and 12 μ long.

It is evident from this description that the plant shows great likeness to the one found in *Hypnea musciformis*. Nevertheless some differences are present. For instance the erect filaments grow taller and therefore proportionally more slender than those

[1]) Bornet, Ed., Deux *Chantransia corymbifera* Thuret. *Acrochaetium* et *Chantransia* (Bull. Soc. bot. France, Tome 51, 1904, p. XX).

of the typical *Acr. repens*. As to the occurrence of the sporangia a difference, too, seems to be present as the pedicels, bearing the sporangia in *Acr. repens*, are often placed directly upon the main filament, while in the plant upon *Griffithsia* these, in the scanty material found, are always placed upon the lowermost cells of the side-branches.

By its large, widely spreading system of endophytic filaments our plant, too, reminds very much of *Acr. Nemalionis* (De Not.) Bornet, but it is, nevertheless, very different when compared with ROSENVINGES[1]) exhaustive description, the *Acr. Nemalionis* being a much taller, more robust and much more ramified plant.

The *Griffithsia* in which this plant was growing was dredged in about 5 fathoms of water in the month of January.

St. Croix: Near Buck Island.

28. **Acrochætium phacelorhizum** Børgs.

29. **Acrochætium Collinsianum** Børgs.

Syn. *Acrochætium Liagoræ* Børgs., p. 57.

In the year of 1914 Mme WEBER in the Marine Algæ of "The Percy Sladen Trust Expedition"[2]) has described a *Chantransia Liagoræ* found on *Liagora Hawaiiana*. The *Acrochætium* (*Chantransia*) *Liagoræ*, which I described a year later in the first part of this volume, must therefore have another name, and I propose to call it *Acr. Collinsianum* in honour of the well known American phycologist, Mr. FRANC S. COLLINS, who has contributed largely not only to our knowledge of the American *Acrochætium* species, but to our knowledge of American algal flora in its entirety. I deeply regret to say that it will not only be in honour of FRANK S. COLLINS, but also in memory of him. Because, after the MS. had left my hands and gone to the printers, Dr. HOWE informed me by letter that COLLINS, the enthusiastic algologist, had suddenly died. His death is a great loss to science, but I also feel it as a deep personal one, having corresponded with F. S. COLLINS during many years.

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[1]) ROSENVINGE, L. KOLDERUP, The marine algæ of Denmark, Part I, Rhodophyceæ, p. 126.

[2]) In The Transactions of the Linnean Society of London; 2. ser. Zoology, vol. 16, part. 3, London 1914.

30. **Acrochætium ernothrix** Børgs.
31. **Nemalion Schrammi** (Crn.) Børgs.
32. — **longicolle** Børgs.

33. **Liagora elongata** Zanard.

In the "Algæ of Bermuda", p. 99, Collins and Hervey refer *Liagora corymbosa* J. Ag. to *Liagora elongata* Zanardini, pointing out that it is impossible to separate them from each other. The single dried specimens found I have with much doubt (comp. p. 70) referred to *L. corymbosa* J. Ag. as I found its anatomical structure agreeing closely with that of *L. elongata.* I therefore now prefer to consider it as a form of *Liagora elongata*, in accordance with the opinion of Collins and Hervey.

34. **Liagora valida** Harv.
35. — **pinnata** Harv.
36. — **megagyna** Børgs.
37. — **pulverulenta** C. Ag.

Appendix to Liagora.

Before I leave the genus *Liagora* I wish to mention here some remarkable organisms, which I found in several of the species, when working out my material of this genus, and from which the drawings here reproduced were made at the time (Fig. 421). When I found these bodies, I was inclined to consider them as a kind of endophytes living in the mucous layer of *Liagora.* But feeling very uncertain what to do with them, I wrote to Dr. Howe wishing to hear if he also had met with them. Dr. Howe wrote to me that he, too, had found these bodies in several species of *Liagora* and that he, too, felt rather uncertain what to do with them. At first he was on the point of describing them as representing a new genus of uncertain family, but later after having made more thorough examination he arrived at the conclusion "that these discs seemed to spring from terminal or subterminal cells of the assimilatory filaments of the *Liagora*, usually after rejuvenescence of the cell". Dr. Howe told me that he had written a paper describing the discs and their supposed origin, but that he had put it aside feeling not so sure of the matter as he would like to be, before putting it into print.

Dr. HOWE's interesting paper[1]) has now appeared, and though I am not able to give any better explanation as to these peculiar bodies, I nevertheless wish to give here a short description being able in some respects to make a few additions to the description by Dr. HOWE.

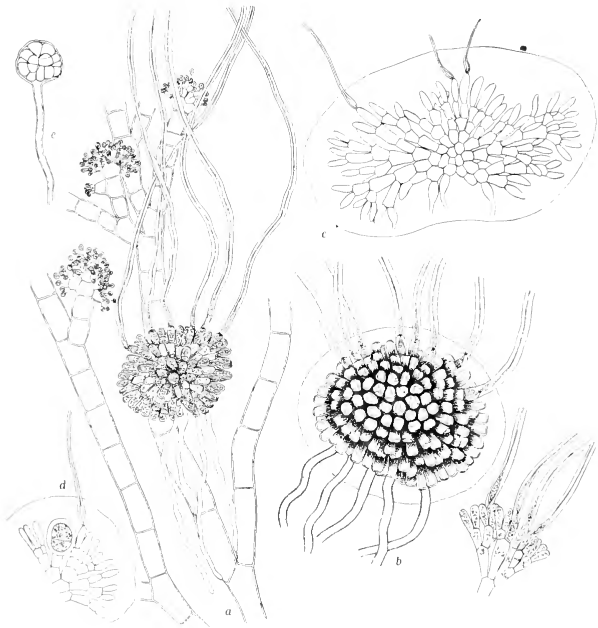

Fig. 421. Endophytic organisms in *Liagora*.
a, a body fixed to the filaments of *Liagora*. *b*, another specimen more magnified. *c*, transverse section. *d*, part of a specimen with sporangium. *e*, a young specimen. *f*, part of a crushed specimen.
(*a*, about 300:1; *b*, *f*, about 500:1; *c*, *d*. *e*, about 275:1.)

These bodies I have found, in common with HOWE, in several species of *Liagora*, but especially abundantly in *Liagora elongata* and therefore I restrict my description to those from this species (Fig. 421).

[1]) M. A. HOWE, Observations on Monosporangial Discs in the Genus Liagora. (Bull. Torrey Bot. Club, 47, 1920).

The shape of the bodies, when fully developed, is like a subglobular thick disc, their diameter reaching a maximum of about 200 μ or possibly a little more. From the flattened upper side of these discs long hairs arise and from the opposite under side long rhizoids are given off (Fig. 421 *a*, *b*). The hairs are very long; they have a well developed pore at their base, granular contents, especially in their lower part, and thick walls. At their base they are about 7—10 μ thick growing thinner upwards. The rhizoids have no granular contents; their walls are thin. They are about 5 μ thick. The rhizoids run down along the assimilating filaments of the *Liagora* or spread freely in the mucilage of the host plant (Fig. 421 *a*). Both hairs and rhizoids are often present in great number, 10—12 or even more. The surface of the bodies consists of the more or less free obtuse ends of the peripheral cells. They are surrounded by a thicker or thinner mucous layer.

From a transverse section (Fig. 421 *c*) it is seen that the disc is composed in the middle of a parenchymatic tissue formed of thin-walled, roundish-polygonal cells. These are arranged in filaments radiating towards the periphery and are subdi-trichotomously ramified several times. The growth takes place in the peripheral cells, these are long, thin and, as mentioned above, more or less free.

In one of the transverse sections sporangia were found (Fig. 421). These are formed from the peripheral cells and are oval in shape. One of these was divided by means of a transverse wall into two spores; the whole sporangium was sourrounded by a thick transparent wall commonly found round the tetraspores. Howe has in his specimens found only monosporangia, and similar bodies (comp. Howe's figures) I, too, have often seen in mine.

Regarding the chromatophores Howe says that they seem similar to those of *Liagora* but those of the discs are more red. In my specimens the chromatophores appear to be a few parietal plates.

Finally I must add that these bodies are found in all states of development from quite small to larger ones.

The function of these little bodies has yet to be made clear. In his paper Dr Howe tries to make it evident that they originate from the *Liagora* itself. He says" The truth seems to be that these discs arise from gonidia, gemmæ or aplanospores, derived

from the terminal or subterminal cells of the assimalitory filaments of the *Liagora*, as was the view of KÜTZING[1]) in regard to similar structures in *Liagora Turneri*". And HOWE describes and gives figures of this continuity, but he points out himself that the observed evidences of direct continuity were not so numerous as he might wish.

I have not in my material been able to find any organic continuity between this organism and the host-plant, and I am therefore most inclined to consider it as an independent plant. As is already pointed out by Dr. HOWE it seems both easier and more probable to consider these bodies as independent endophytic structures.

Finally I can only wish, just as Dr. HOWE does, that some one, who has access to suitable living material, would be able to solve the question by means of a thorough examination.

38. **Scinaia complanata** (Collins) Cotton.

Galaxaura Lamouroux.

When I worked out my material of this genus I, of course, founded my determinations on the rather recently published comprehensive monograph by KJELLMAN.

The material I have collected of this genus was rather poor, these plants being not very attractive, and rather slow and difficult to dry and taking up much space in the bottles. Nevertheless through KJELLMAN's work I arrived at the conclusion that eleven species were present at the islands.

But I want to point out that the determination of the species from the work of KJELLMAN is not without difficulty. Many of his species are surely based upon scanty material and are often at the best only varieties or forms of the same plant.

The highly interesting and instructive examinations by Dr. HOWE[2]) have amply proved that this is the case. The fact is that this well known American investigator has arrived at the con-

[1]) KÜTZING, F., Tab. phycologicæ, vol. VIII, pl. 90.

[2]) HOWE, M. A., in Brooklyn Botanic Garden Memoirs, vol. I, 1918, p. 191.

clusion that, in spite of the very different anatomical features found in the different forms and upon which KJELLMAN based his grouping of the species, KJELLMAN's "species" of one of the groups nevertheless represent, in all probability the tetrasporic or sexual form of another "species" referred to another group.

For instance the species of the sectio "*Vepreculæ*" of KJELLMAN represent the sexual plants, and those of the sectio "Brachycladia" the tetrasporic plants of corresponding species. And the group *Rhodura* is made up of tetrasporic plants whose corresponding male and female plants are to be found in the groups *Microthoë* and *Eugalaxaura* of KJELLMAN.

How different the two corresponding forms of the same plant are, is best seen by comparing some of my figures of the anatomical structure as given above. Nobody would imagine taht the *Galaxaura occidentalis*, as it is described and figured on pag. 110—11, could belong to the same species as *G. marginata*, the anatomical structure of which is shown in Fig. 116.

According to HOWE the forms found in the West Indies might be grouped in this way:

39. **Galaxaura marginata** (Sol.) Lamx.
(sexual form: *G. occidentalis* Børgs.).

40. **Galaxaura squalida** Kjellm.
(tetrasporic form: *G. flagelliformis* Kjellm.).

41. **Galaxaura rugosa** (Solander) Lamx.
(tetrasporic form: *G. subverticillata* Kjellm.).

42. **Galaxaura cylindrica** (Solander) Kjellm.
(tetrasporic form: *G. lapidescens* (Sol.) Lamx.

43. **Galaxaura oblongata** (Ell. et Sol.) Lamx. according to Howe, the right name for *G. fragilis* (Lamarck.) Kjellm.
(tetrasporic form: *G. comans* Kjellm.).

44. **Gelidium corneum** (Huds.) Lamour.
45. **Wrangelia Argus** Mont.
46. — **bicuspidata** Børgs.
47. — **penicillata** C. Ag.
48. **Halymenia Floresia** (Clem.) Ag.
49. **Grateloupia filicina** (Wulf.) Ag.
50. — **dichotoma** J. Ag.
51. — **cuneifolia** J. Ag.

Cryptonemia J. Ag.

52. **Cryptonemia crenulata** J. Ag.

J. Agardh, Nya alger från Mexico (Öfvers. k. Vet.-Akad. Forh. 1847, p. 11, the note); Spec. Alg., vol. II, p. 225; Epicrisis, p. 163. Harvey, W. H., Nereis Bor.-Am., part II, p. 184. Kützing, F., Tab. Phycol., vol. 19, tab. 31.

Pyllophora crenulata J. Ag., In Hist. Alg. Symbolæ (Linnæa, vol. 15, 1841, p. 18).

Areschoug, J. E., Icones algarum, 1847, p. 1, tab. II. Kützing, Spec. Alg., p. 791.

Phyllophora denticulata Kütz., Tab. Phycol., vol. 19, tab. 77.

Two small collections have been found. One of them was dredged in deep water and consists of small plants growing epiphytic upon a piece of coral. The plants have a small basal disc and a very short stipe from which the thallus quickly broadens out, the broadest part being somewhat over $^1/_2$ cm. broad. It is several times subdichotomously ramified. The margin is somewhat sinuate and irregularly dentate.

The other specimen was most probably growing in shallow water. It is a larger plant with much broader thallus, more than one cm. broad, and more proliferous and, on the whole, very irregularly ramified. The margin is sinuate with larger and smaller teeths.

Both specimens were sterile.

St. Croix: near White Bay. St. Jan: near Rams Head (ca. 20 fathoms).
Geogr. Distrib.: West Indies, Brazil.

53. **Contarinia Magdæ** Web. v. Bosse.
54. **Cruoriopsis** spec.
55. **Peyssonnelia armorica** (Crn.).
56. — **Dubyi** Crn.
57. — **Boergesenii** Web. v. Bosse.
58. — **Nordstedtii** Web. v. Bosse.
59. — **simulans** Web. v. Bosse.
60. — **conchicola** Picc. et Grun.?
61. — **polymorpha** (Zan.) Schm.?
62. — **rubra** (Grev.) J. Ag.
63. **Hildenbrandia prototypus** Nardo.
64. **Lithothamnion mesomorphum** Foslie.
65. — **sejunctum** Foslie.

66. **Lithothamnion ruptile** Foslie.
67. — **occidentale** Foslie.
68. **Lithophyllum accretum** (Fosl. et Howe) Lem.
69. — **caribaeum** Fosl.
70. — **erosum** Fosl.
71. — **intermedium** Fosl.
72. — **daedalum** Fosl. et Howe.
73. — **strictum** (Fosl.) Lem.
var. *nana* Fosl. et Howe.
74. — **absimile** Fosl. et Howe.
75. — (?) **propinquum** (Fosl.)
76. — **prototypum** Fosl.
77. **Melobesia farinosa** Lamx.
78. — **Chamaedoris** Fosl. et Howe.
79. — **atlantica** (Fosl.) Lem.
80. — **affinis** (Fosl.) Lem.
81. **Porolithon mamillare** (Harv.) Lem.
var. *occidentalis* Fosl.
82. — **Boergesenii** (Fosl.) Lem.
83. — **pachydermum** Fosl.
84. **Amphiroa rigida** Lamx.
85. — **fragilissima** (L.) Lamx.
86. **Corallina cubensis** (Mont.) Kütz.
87. **Jania pumila** Lamx.
88. — **adhaerens** Lamx.
89. — **decussato-dichotoma** Yendo.
90. — **capillacea** Harv.
91. — spec.

92. **Spermothamnion investiens** (Crouan) Vickers.
var. *cidaricola* Børgs.

Besides the var. *cidaricola* (comp. p. 200), which covers the spikes of *Eucidaris tribuloides* quite densely, I have come across a closely related form which in a similar way may densely cover the stems of *Chamædoris Peniculum* to which it is fastened firmly by means of the numerous short rhizoids given off from the basal creeping filaments (Fig. 422 *a*). The rhizoids are unicellular, ending in a broad disc with coralliform outline. The creeping filaments are upto 35 μ thick.

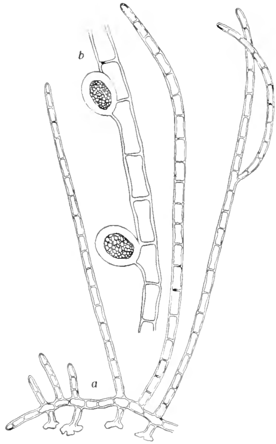

Fig. 422. *Spermothamnion investiens* (Crouan) Vickers. *a*, part of a plant. *b*, part of a filament with sporangia. (*a*, about 70: 1; *b*, about 140: 1.)

From the creeping filaments the erect ones arise. These are mostly simple, bearing now and then — for the most part in their upper end — one or more branches but never many. The erect filaments are nearly cylindrical; they are 24—27—31 μ thick. The length of the cells about 70– 80 μ.

A few tetrasporangia were found (Fig. 422 *b*). They were sessile, roundish-subreniform in shape with a thick periferal wall, about 45 μ broad and 50 μ long. The sporangia occurred upon the main filament.

The plant was gathered near the shore in a rather exposed rocky locality; it had tetrasporangia in the month of January.

St. Croix: White Bay.

93. **Griffithsia globifera** (Harv.) J. Ag.

94. **Griffithsia tenuis** Ag.

C. Agardh, Spec. Alg., vol. II, p. 131. J. Agardh, Spec. Alg. vol. II, p. 84; Epicrisis, p. 70. Collins and Hervey, Alg. Bermuda, p. 135, pl. VI, figs. 38—39.

Griffithsia thyrsigera Askenasy, Forschungsreise "Gazelle", IV Theil, Bot., p. 36, pl. IX, figs. 1 and 4.

Callithamnion tenue Harvey, Nereis Bor.-Am., part III, p. 130.

Creeping upon some larger algæ I have found some well developed tetrasporic specimens of this plant (Fig. 423).

As pointed out by Collins and Hervey the *Griffithsia thyrsigera* Askenasy and *Callithamnion tenue* of Harvey do belong to this species. Regarding Askenasy's description of the tetrasporic plant, some differences are certainly present, but this is, as indicated by Collins and Hervey, most probably due to the more luxuriant development of the West Indian plant.

Griffithsia tenuis forms very loose tufts composed of the irregularly ramified filaments. It is fixed to the host plant by means of vigorous rhizoids breaking out from the decumbent creeping

part of the filaments (Fig. 423 *a*). The rhizoids are unicellular, having in their basal end a flat roundish, coralliform disc. The rhizoids are given off mostly in the basal proximal ends of the cells near the cross walls (Fig. 423 *a*), but now and then, too, a rhizoid (mostly smaller) is issued in the upper (distal) end of the adjacent cell.

The ramification is not very abundant; being mostly restricted to a few branches in the older parts of the thallus, the upper ends of the filaments often being undivided. As pointed out by Askenasy a peculiarity is to be noted regarding the issue of the branches, these not being given off at the distal end of the cells, as is ordinarily the case in related forms, but near the basal wall of the cells (Fig. 423 *a*).

The cells are nearly cylindrical or a little thicker at both ends; about 200 μ thick and 4—6 times as long. The wall is thick in the older parts of the thallus. Near the apex of the filaments the young cells become gradually shorter and a little swollen at their upper end.

Round the upper end of the young cells is early formed a dense ring composed of several rows of hairs. These are di-trichotomously ramified and are soon shed, long before the cell has reached its normal size.

The tetrasporangia (Fig. 423 *b*) are formed upon shorter or longer, pyriform to clavate, unicellular pedicels, one upon each of these. They form a dense ring at the upper ends of the cells, a little above that of the hairs or scars of these. Askenasy found about ten only in each

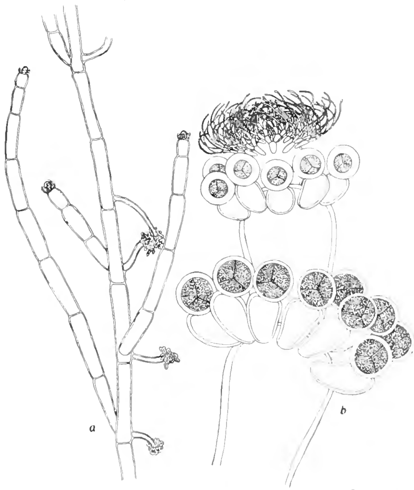

Fig. 423. *Griffithsia tenuis* Ag. *a*, basal part of a plant. *b*, apex of filament with tetrasporangia. (*a*, about 17:1 *b*, about 85:1).

ring; in the West Indian plant, as pointed out by Collins and Hervey, too, about 15 are often present. Mostly each filament bears two to three whorls, but sometimes more than six whorls are successively developed. The diameter of the mature tetrasporangia is about 100 μ.

The antheridial stands are described and figured by Askenasy; they are formed terminally upon short pedicels of one to three cells (comp. Collins and Hervey, The Algæ of Bermuda, p. 135). The cystocarps seem to be insufficiently known. Askenasy describes, but in a very fragmentary manner, one found by him and Collins and Hervey only say that "they are characteristic of *Griffithsia*".

The plant was gathered with tetraspores in the month of January. It was found in shallow water near the shore in a rather sheltered place behind the protecting coral reef.

St. Croix: Lime Tree Bay.

Geogr. Distrib.: Mediterranean Sea, West Indies, New Guinea, Bermuda etc.

95. **Griffithsia barbata** (Engl. Bot.) Ag.

C. Agardh, Spec. Alg., vol. II, p. 132. J. Agardh, Spec. Alg., vol. II, p. 80; Epicrisis, p. 64. Kützing, Spec. Alg., p. 660; Tabul. Phycol., vol. XII, tab. 24. Harvey, Phycologia Britannica, tab. 287.

Conferva barbata Smith, Engl. Botany, tab. 1814.

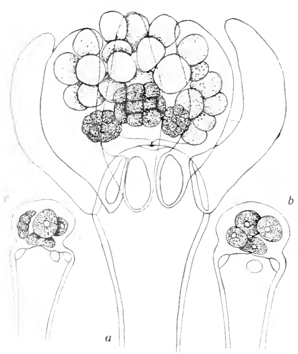

Fig. 424. *Griffithsia barbata* (Smith) Ag. *a*, a nearly ripe cystocarp. *b* and *c*, a procarp seen from two opposite sides. (*a*, about 175:1; *b* and *c*, about 150:1.)

Of this plant I have twice come across a few filaments of female plants. In the one collection, found between some different algæ gathered at Lt. Princess, St. Croix, a young procarp was present. It is a well known fact that the procarp in this species is developed terminally upon a short branchlet composed of a single joint. The Fig. 424 *b*, *c* shows a young procarp seen from two different sides. From this it is seen that the basal central cell bears two pericentral

cells and furthermore the carpogonial branch. If this is normally the case then the difference from *Gr. globifera* is great; in that species likewise only a single carpogonial branch is present,the carpogonial branch in *Gr. globifera* being, as described by LEWIS[1]), formed from the second or third peripheral cell.

The cystocarps are surrounded by an involucrum composed of about eight cells, growing out from the upper end of the terminal joint cell. These cells are long and curved over the cystocarp (Fig. 424 *a*). According to ZANARDINI[2]) and HAUCK[3]) the rays of the involucrum are either undivided or consist of two to three cells.

The vegetative cells were about 100 μ broad and four to five times as long.

The plants were collected in the month of February and March, the one in shallow water near the shore, the other in a depth of about 30 meters.

The *Griffithsia* spec., mentioned above on pag. 208, belongs most probably to this species.

St. Croix: Lt. Princess; St. Jan: off Cruz Bay in the sound between this island and St. Thomas.

Geogr. Distrib.: Mediterranean Sea, warmer parts of the Atlantic European coast.

96. **Mesothamnion caribaeum** Børgs.

97. **Callithamnion cordatum** Børgs.

98. — **byssoides** Arn.

99. — spec.

100. **Seirospora occidentalis** Børgs.

101. **Antithamnion Butleriæ** Collins.

COLLINS, Fr. S., The Algæ of Jamaica (Proceed. of the Amer. Acad. of Arts and Scienc., vol. XXXVII, 1901, p. 258).

Some small fragments (Fig. 425) of this delicate plant were found creeping upon *Lophosiphonia obscura.* These seem to accord with the description given by COLLINS. The main filament reaches a breadth of up to 30 μ, its cells a length of about four time the breadth. The wall is thick. In the lowermost part of

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[1]) LEWIS, The Life History of Griffithsia Bornetiana (Annals of Bot., vol. 23, 1909, p. 657).

[2]) ZANARDINI, Iconogr. Phycol. Med.-Adriat. II, p. 39, pl. 50.

[3]) HAUCK, Die Meeresalgen Deutschl. und Oesterreichs, p. 91.

the filaments the opposite branches are issued nearest the basal (proximal) wall of the cells in a way similar to that found in *Griffithsia tenuis* (Fig 425 *c*); higher up in the thallus, on the other hand, the branches issue always a little below the upper cross-wall of the cells (Fig 425 *a*, *b*)

In the basal part of the thallus some of the cells are naked or bear only a single short ramulus, but soon each cell bears two opposite branches, which, when the thallus reaches its highest development, first gradually develop ramuli from their lower side and later from their upper side also. The rachis of the pinna consists of about 10 cells, the ramuli on the lower side seldom of more than 3 to 4 cells, those on the upperside of 2 to 3. The length of the whole pinna is about 500 μ.

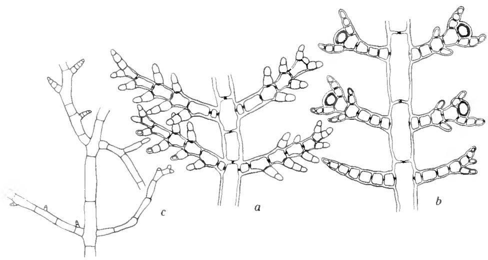

Fig. 425. *Antithamnion Butleriæ* Collins. *a* and *b*. parts of the thallus with glands. *c*, part of the thallus near the base. (*a*, *b*, about 175:1; *c*, about 60:1.)

The uppermost cell in the rachis of the pinnæ is often transformed into a gland-cell (Fig 425 *b*). This gland-cell is short and broad with roundish summit and has the usual transparent, homogenous contents. Now and then, too, the end cell of the ramuli are transformed into a gland-cell (Fig. 425 *a*). The specimens found were sterile.

Found once in shallow water near the shore.

St. Croix: White Bay.
Geogr. Distrib.: Jamaica, Barbadoes.

102. **Antithamnion antillanum** Børgs.

103. — spec.

104. **Crouania attenuata** (Bonnem.) J. Ag.

105. **Spyridia filamentosa** (Wulf.) Harv.

After having finished my description of this plant (p. 233) I have come across an antheridial plant. The antheridial stands

are formed near the base of the ramuli covering densely several cells. The antheridial stands were first observed by FARLOW who in "The Marine Algæ of New England", p. 140, pl. X, fig. 1 has described and figured them.

Tetrasporangia, cystocarps and antheridia were found in the months January to March.

106. **Spyridia clavata** Kütz.
107. — **aculeata** (Schimp.) Kütz.
var. *typica.*
var. *disticha* Borgs.
f. *inermis* Børgs.
108. **Centroceras clavulatum** (Ag.) Kütz.
109. **Ceramium fastigiatum** (Roth) Harv.
110. — **strictum** Grev. et Harv.
111. — **transversale** Coll. et Herv.
112. — **nitens** (Ag.) J. Ag.
113. **Laurencia Poitei** (Lamx.) Howe.
114. — **papillosa** (Forsk.) Grev.
115. — **obtusa** (Huds.) Lamx.
var. *gelatinosa* (Desf.) J. Ag.
116. — **implicata** J. Ag.
117. — **chondrioides** Børgs.
118. — **cervicornis** Harv.

119. **Chondria polyrhiza** Coll. et Herv.

The first time I examined this plant I had only a dried specimen at my disposal, now I have come across some more material, some of it preserved in alcohol.

In this material the group of rhizoids were not so very abundant, being mostly restricted to the basal parts of the filaments or to filaments becoming decumbent or approaching other algæ etc. to which they could fix themselves.

A transverse section shows that the thallus is terete (Fig. 426 *b*), and that the cells have very thin walls. The small central cell is surrounded by four to six large pericentral cells; at the periphery these have, for the most part, some smaller cells, the whole being encircled by a thin cortical layer of quite small cells.

The branches have rather broad bases (Fig. 426 *a*), these

being but slightly narrowed or not at all; upwards the narrowing of the branches is, for the most part, slight and gradual until rather suddenly, near the summit, they start tapering rapidly into the acute apex.

As described by COLLINS and HERVEY the tetrasporangia are formed in the upper ends of the branches (Fig. 426 *a*); the fructiferous part is swollen being often about twice the breadth of the sterile, slender part.

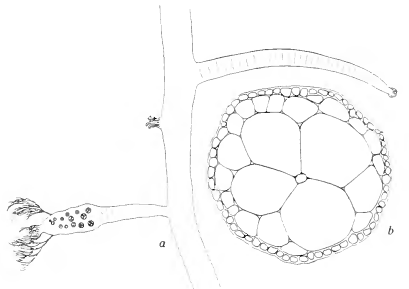

Fig. 426. *Chondria polyrhiza* Collins and Hervey. *a*, part of thallus with a group of rhizoids and a tetrasporic branch. *b*, transverse section of the thallus. (*a*, about 17:1; *b*, about 60:1.)

In several respects, for instance, as to its whole appearance, this plant shows great likeness to the *Laurencia chondrioides* described by me, but on closer examination several differences will soon be observed, for instance, the acute apex of the thallus, the pericentral cells easily seen through the cortical layer, the different shape of the branches especially the tetrasporic ones and the highly deviating transverse section.

Found with tetraspores in the month of March.

The specimens were gathered in the same locality as those formerly examined.

St. Jan: off Cruz Bay.

120. **Chondria atropurpurea** Harv.
121. — **littoralis** Harv.
122. — **dasyphylla** (Woodw.) Ag.
123. **Acanthophora spicifera** (Vahl) Børgs.
124. — **muscoides** (L.) Bory.
125. **Polysiphonia havanensis** Mont.
126. — spec.
127. — **variegata.** (Ag.) Zan.
128. — **sphærocarpa** Børgs.
129. — **macrocarpa** Harv.
130. — **ferulacea** Suhr, J. Ag.

131. **Digenea simplex** (Wulf.) Ag.

In a collection consisting of various algæ I have come across the male plant of this species. The antheridial stands have previously been known only from a figure in KÜTZING's "Tabulæ Phycologicæ", vol. 15, pl. 28, fig. m. Concerning this figure FALKENBERG in his monograph of the *Rhodomelaceæ* writes p. 160: "Die Antheridien habe ich zwar nicht selbst gesehen, aber die Abbildung KÜTZING's lässt wohl kaum eine andere Deutung zu, als dass es sich bei *Digenia* in der That um flache, ovale Antheridien handelt, die am oberen Ende der Sprosse gehäuft stehen. Ich wäre eher geneigt, die Abbildung auf misverstandene eingekrümmte Blätter zu deuten, wenn ich nicht bei *Bryothamnion* analoge flache Antheridien gefunden hätte".

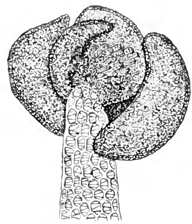

Fig. 427. *Digenea simplex* (Wulf.) Ag. Summit of the thallus with antheridial stands. (About 80:1.)

The male plants recently discovered by me prove that KÜTZING has had such a plant at his disposal. The antheridial stands are, when fully developed, discoid bodies of oblique reniform shape; their entire surface is covered by the antheridia.

A whole trichoblast is used to the formation of the antheridial stand just as in the case of *Bryothamnion* according to FALKENBERG's description (l. c., p. 175), and its development takes place in a very similar way. From an apical cell with two sides segments are cut off alternately at both sides. These segments or branches remain together, increasing gradually in length and at the same time dividing into smaller cells; and this process is carried on until the above mentioned flat bodies are formed.

The antheridial plant was found in the month of January in shallow water near the shore.

St. Croix: Lt. Princess.

132. **Bryothamnion triquetrum** (Gmel.) Howe.
133. — **Seaforthii** (Turn.) Kütz.

134. **Herposiphonia secunda** (Ag.) Falkenb.

As pointed out in my previous description of *Herposiphonia*. I was most inclined to consider the two species *H. tenella* and

H. secunda as nothing else but two forms of the same plant. This opinion I founded on the fact that the supposed different ramification, being the only real difference between them, would not be proof against a thorough examination of more extensive material, and this point of view, that the ramification in itself is not a sufficient character of distinction, I still maintain, at any rate, to a certain degree.

Nevertheless, I have now come to the conclusion that we have to do with two different species, my conclusion being based on the fact that I have succeded in finding two very different types of antheridial plants, so different that they necessarily must be regarded as belonging to two distinct species. Had these two different types shown diverse forms of ramification we might perhaps by means of this have been able to refer plants with other fructiferous organs, tetraspores and cystocarps to their respective species. But this was not the case, both plants being ramified with some differences in a rather peculiar way which seems to be characteristic of the male plants.

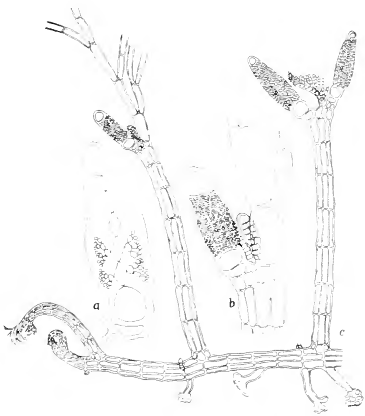

Fig. 428. *Herposiphonia secunda* (Ag.) Falkenb. *a*, transverse section of antheridial stand. *b*, apex of branchlets with antheridial stands in different stages of development. *c*. part of a male plant. (*a*, *b*, about 200:1; *c* about 50:1.)

If we now leave out of consideration the ramification as a character of distinction between the two species and look upon the other differences between them mentioned in the descriptions we find that the most essential one is that *H. tenella* is a more slender plant than *secunda*. Taking this into consideration I now refer the most robust form of the antheridial plants found to *Herposiphonia secunda*, the other to *H. tenella*[1]).

[1]) The third West Indian form, *H. Pecten-veneris* (Harv.) Falkenb. is, I think, nothing else but a form with recurved branchlets and summits of branches.

Before entering upon a description of both plants I wish to point out that both were found growing together upon the same host plant, *Dictyota indica*, in the open sea at a depth of about ten meters. Consequently they were both growing under exactly the same external conditions, these no doubt highly influencing the habit of these plants. They were gathered in the month of February.

So far as I know the antheridial stands of *Herposiphonia* are on the whole known only from the rather imperfect note by FALKENBERG in his monograph, l. c., p. 308.

The antheridial stands in the plant referred to *H. secunda* are formed by the trichoblasts in the upper end of the branchlets (Fig. 428). A whole trichoblast is used to each antheridial stand. They show great likeness to those found in *Polysiphonia*, for instance to those in *Polysiphonia ferulacea*, comp. my fig. 278.

When fully developed the antheridial stands consist of a basal stalk composed (mostly) of two cells, a shorter basal one and a longer above it (Fig. 428); they are both without chromatophores and have very thick walls. The lowermost cell is about 20 μ high, that above from 40 μ to 60 μ long and about 60 μ thick; the peripheral wall is about 8 μ thick. Then follows the fructiferous, polysiphonous part covered all over with the antheridia. It is subcylindrical, about 70 μ thick below, 55 μ above and about 180 μ long. In the specimens I have examined it consists of 4 to 5 segments, the central cells being clearly visible in the middle (Fig. 428 *a*). From the middle of the central cells smaller cells are given off; these are di-tri-tetrachotomously ramified several times in a candelabrum-like manner. The outmost cells are the antheridia.

The whole antheridial stand ends in a terminal sterile cell, about 50 μ long, subpyramidal in shape and like the cells in the stalk with no chromatophores and with very thick wall.

Fig. 428 *b* shows in the middle a young stage of the antheridial stand. From this it is seen that the antheridial part of it consists of short segments becoming gradually polysiphonous.

In the male plants found, the development of the branches and branchlets is much reduced. In some of the plants no trace of branches are found at all, in others these are only very rudi-

mentarily developed; and the branchlets are developed in a very restricted number.

The most common form of ramification found in the male plant is that drawn in the diagram (Fig. 429) and also clearly seen in the Fig. 428 *c* namely, after a segment with a branchlet issuing, as it seems, from the dorsal median line, follows one with a rudimentary branch alternately on the right or left side of the stem, but always on the opposite side of the stem as the foregoing, then three bare segments, then one with a branchlet and one with a branch and so on. In another specimen in which no branches at all were developed I found generally three bare segments between each with a branchlet, once only two bare segments. The branchlets seem all to be issued from the dorsal median line of the main branch, not being arranged in zig-zag form as is commonly the case.

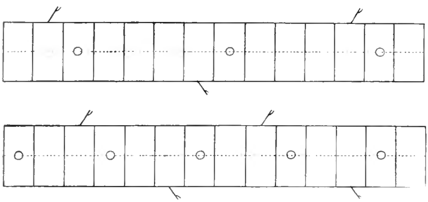

Fig. 429. Scheme of the ramification as found in the male plants of *Herposiphonia secunda* (uppermost) and in *Herposiphonia tenella* (lowermost). (The apical end at the left).

This varying arrangement of branchlets and branches, differing much from that commonly found in *Herposiphonia*, seems to support my view that no systematic value can be attached to it.

So far I have seen, both the main filaments and branchlets of this form have eight pericentral cells. The branchlets are about 80 μ thick.

Of the forms mentioned in my description on p. 286 I now think it best to refer the plants figured in Figs. 288 and 289 to *H. secunda*, these having short segments and being on the whole rather robust.

135. **Herposiphonia tenella** (C. Ag.) Nägl.

The male specimens referred to this plant have more slender antheridial stands than those of *H. secunda* (Fig. 430). Commonly the whole stand together with basal cells and apex reaches a length of about 150 μ (the fructiferous part alone 125 μ) and a breadth of about 40 μ; the largest antheridial stand found on the whole was 240 μ long and 55 μ broad.

Beginning from the base, the stalk consists in the normally developed antheridial stands of two cells (Fig 430 *b*); the lowermost about 12 μ long and 20 μ broad is nearly immersed in the tissue of the branchlet, the uppermost about 12—16 μ long and 24 μ broad has rather thick walls. The antheridial part is nearly cylindrical; it is terminated by a sterile part. This consists in the different specimens of a varying number of short cells, two to five, or sometimes it terminates in a longer trichothallic prolongation (Fig 430 *a*). A few times I have found ramified antheridial stands where, in two cases, a smaller fructiferous branch issued from the second cell in the stalk (comp. Fig. 430 *a*), and in another stand three cells were developed in the stalk, and from the uppermost of these cells a well developed, ramified, trichoblastic, sterile branch issued (Fig. 430 *c*). This shows that in this species there is a tendency not to use the whole trichoblast in the formation of the antheridial stands, this feature, as mentioned above, being in most cases confined to a few sterile cells in the upper end of the antheridial stands, in others to a shorter or longer hairlike prolongation, rarely to a whole ramified trichoblastic branchlet. The whole antheridial stand is generally much curved in this species in contradistinction to the straight ones in *H. secunda*. And while the antheridial stands, rarely more than four, are crowded together in the upper end of the branchlets in *H. secunda*, these, in *H. tenella* (up to a number of ten upon

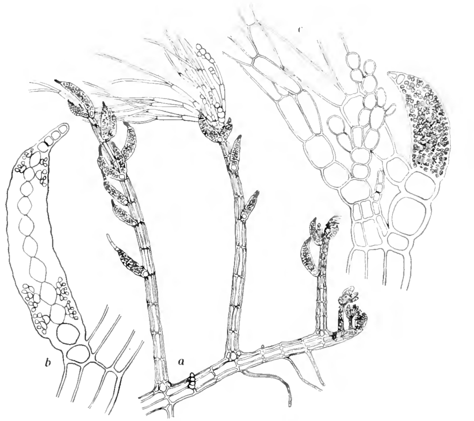

Fig. 430. *Herposiphonia tenella* (Ag.) Nägl. *a*, part of a male plant. *b*, transverse section of antheridial stand. *c*, apex of branchlet with antheridial stand from the third basal cell of which a sterile well developed trichoblastic branch is given off. (*a*. about 50:1; *b* and *c*, about 200:1.)

the same branchlet) are found scattered along the branchlet often one from each segment with the exception of the lowermost. A great number of segments, 10—12 or more, are present in the fructiferous part of this plant, the central cells of which are easily observable (Fig. 430 *b*); in *H. secunda*, as mentioned above, only four to five are present.

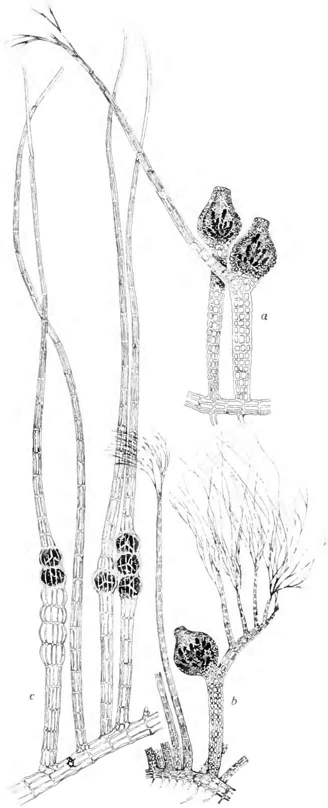

Fig. 431. *Herposiphonia* spec. *a* and *b*, plants with cystocarps (compare the text). *c*, part of tetrasporic plant. (*a* and *b*, about 22:1; *c*, about 50:1.)

As to the ramification of the main stem I have generally found a single bare segment between those with branchlets and branches, as shown in the diagram (Fig. 429). But modification is often present, compare e. g. Fig. 430 *a* where two bare segments are found in one case.

In this form in the main stem, nine pericentral cells were present, in the erect branchlets seven only. The diameter of the branchlets was about 50 μ.

In a collection af various algæ from shallow water gathered at the shore of Water Island at St. Thomas, plants with cystocarps were found. How far these plants really belong to *H. tenella* I dare not say with certainty. The ramification, at any rate, was the common one answering to the diagram of it given by Falkenberg, l. c. p. 303.

As described by Falkenberg, l. c., p. 309, pl. 3, fig. 10 the procarps are formed in the trichoblasts in the upper end of the branchlets. The branchlets, which bear the cystocarps, become

more robust, having much shorter and broader segments than those of the vegetative branchlets in the same plant. The ripe cystocarps are frequently placed in the upper end of the branchlets (comp. Fig. 431 *a*), but not always. Often the branchlets, bearing the cystocarp, get renewed growth, attaining a considerable length and in this way giving rise to a new branchlet (comp. Fig. 431 *a*), these being composed of about the same number of segments as the common branchlets and in their upper end terminated by trichoblasts.

And this development may be carried on still further. I have found several specimens in which the branchlet growing out below the cystocarp gets indefinite growth like the main filaments; branchlets grow out from its dorsal side and it may develop into a normally built main axis (Fig. 431 *b*). While in my specimens the above mentioned three different cases occurred, Falkenberg in his specimens has only found one form: a branchlet growing out below the cystocarp. Falkenberg accounts for this peculiar phenomenon by the increased supply of nutrition to the cystocarps, which also benefits the branchlets and favours the growth.

The cystocarps are urceolate with a rather long neck and a wide opening; they are about 300 μ broad and 400 μ long.

The plant was found with cystocarps in the month of January.

A slender form with tetraspores (Fig. 431 *c*) was once dredged in deep water. The branchlets in this form are very long; at their base about six sterile segments were present followed by one to six fructiferous segments and finally a long sterile upper end composed of about twenty long, but slender segments tapering slowly upwards. The ramification of this plant was the same as the cystocarpic plants, mentioned above.

This plant was found at a depth of about 30 meters in the month of March in the sound between St. Jan and St. Thomas: off Cruz Bay.

136. **Dipterosiphonia dendritica** (Ag.) Falkenb.

137. **Lophosiphonia obscura** (Ag.) Falkenb.

138. **Lophosiphonia cristata** Falkenb.

In my previous examination of this plant I had only sterile material at my disposal, now I have come across specimens with cystocarps and tetraspores.

As always in the case of the Fam. of the *Rhodomelaceæ* it is from the second joint of the young trichoblasts that the procarp originates. The lowermost joint of the trichoblast becomes polysiphonous, too, while the upper end of the trichoblast soon dies away.

Fig. 432 *a* shows a quite young procarp. Fig. 432 *b* a more advanced stage at the moment of fecundation. We see here the four-celled carpogonial branch from which the long thin trichogyne (specimens have been found in which the trichogyne has twice

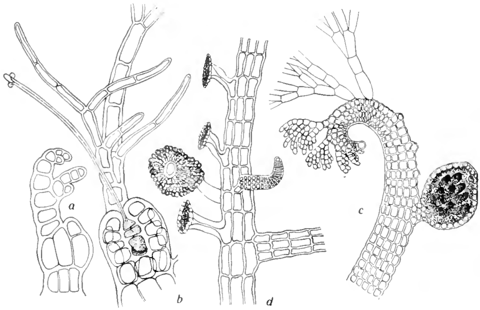

Fig. 432. *Lophosiphonia cristata* Falkenb.
a, quite young procarp. *b*, more developed procarp in the stade of fertilization. *c*, upper end of erect filament with cystocarp. *d*, part of basal creeping filaments with rhizoids ending in large roundish discs.
(*a* and *b*, about 260:1; *c*, about 150:1; *d*, about 60:1.)

the length of the one drawn in the figure) protrudes; two spermatia are fixed to its upper end. The fully developed cystocarp (Fig. 432 *c*) is oblique urceolate with a rather broad opening in its upper end. It is about 200 μ long and 170 μ broad.

The tetrasporangia have been found by Falkenberg and I refer to his description (l. c., p. 500). The tetrasporangia are formed one in each segment in the upper end of the erect filaments and in adventitious short branchlets, of which several were present in the specimens found. They are spirally arranged.

The specimens with cystocarps and tetraspores were found in the month of January. Together with *Herposiphonia tenella*, *Laurencia* and blue-green algæ it formed low dense crusts upon the rocky shore of Water Island at St. Thomas.

139. **Bostrychia tenella** (Vahl) J. Ag.
140. **Lophocladia trichoclados** (Mert., C. Ag.) Schmitz.
141. **Wrightiella Tumanowiczii** (Gatty) Schmitz.
142. **Murrayella periclados** (Ag.) Schmitz.
143. **Dasya pedicellata** Ag.
144. — **mollis** Harv.
145. — **caraibica** Børgs.
146. — **ocellata** (Gratel.) Harv.
147. — **corymbifera** J. Ag.
148. **Heterosiphonia Wurdemanni** (Bail.) Falkenb.
var. *typica* Børgs.
var. *laxa* Børgs.
149. **Dictyurus occidentalis** J. Ag.
150. **Falkenbergia Hillebrandii** (Born.) Falkenb.
151. **Cottoniella arcuata** Børgs.

Shortly after the publication of part V of this treatise, in which I described this plant, I got a letter from Dr. Howe of New York in which he most kindly called my attention to a plant which he some years ago had described and referred to the genus *Sarcomenia*, namely *S. filamentosa* Howe[1]). I regret very much that I have overlooked it, as it seems to come very near to the plant I have found.

Fortunately I do not think that the mischance I have had in overlooking Dr. Howe's plant will have any influence on my new genus. If we, namely, consider the species hitherto referred to the genus *Sarcomenia* we will soon find out that these are very heterogeneous, and this fact has also been pointed out by Grunow[2]), Agardh[3]) and recently by Howe, l. c. Concerning this matter I wish to quote here what Howe writes; l. c., p. 572: "*Sarcomenia filamentosa* does not appear to be very closely related to any of the described species of this chiefly Australian genus. The only other species to which monosiphonous filaments are attributed are, so far as we can discover, the Australian species *Sarcomenia tenera* (Harv.) J. Ag., *S. dolichocystidea* J. Ag., *S. opposita* J. Ag. and *S. secundata* J. Ag., but these are all much

[1]) Howe, M. A., Phycological Studies, II. (Bull. Torrey Bot. Club, 32, 1905, p. 571, pl. 27 and pl. 29, figs. 1—11).

[2]) Grunow, A., Algæ in Reise der Oester. Fregatte Novara, 1870, p. 93.

[3]) Agardh, J., Analecta Algologica, Cont. 5, 1899, p. 130.

coarser plants with Dasyoid or Cliftonioid rather than Polysiphonioid habit, and the origin and arrangement of the branchlets and monosiphonous filaments are more or less different in all of these. In its delicate Polysiphonioid habit, *S. filamentosa* is nearer the group which includes *S. miniata* (Ag.) J. Ag. (the type of which we have seen in Herb. AGARDH), *S. intermedia* Grunow, and *S. mutabilis* (Harv.) J. Ag., but these differ not only in absence of monosiphonous filaments, but also in cortex characters, etc.; in *S. mutabilis*, also, the branches have a marginal or submarginal instead of mid-central origin.

The apparent incongruity of referring delicate plants of the miniata type to a genus originally based upon the fleshy membranous *Sarcomenia delesserioides* has already been remarked by GRUNOW and discussed at length by J. AGARDH. In placing the above-described new species in *Sarcomenia*, we accept, for the present, the current conception of the limits of the genus".

This shows that HOWE had some doubts when he referred his plant to this genus which already has so many different components making it yet more heterogeneous. A division of it seems therefore rather desirable, a beginning being now made by classing the genus *Cottoniella* as a representative of the two American species, *Cottoniella filamentosa* and *C. arcuata.*

In his above mentioned letter Dr. HOWE suggested that the two plants might perhaps be identical. However, according to the description by HOWE this does not seem to be the case, as several differences are present. With reference to those we may first point out that the monosiphonous filaments in my plant are arranged in zig-zag formation in two rows, as against one row in HOWE's. The upper ends of the branches in *C. filamentosa* do not seem to be archshaped like those in *C. arcuata.* And I have never found in mine similar flattened parts of the filament. as shown in fig. 2 or cross sections (3 or 4) in HOWE's figures. Nor have I found such a well developed cortex as is shown in HOWE's fig. 9, whilst the oldest and thickest filaments in my plant looked like my fig. 336 *b*. On the whole my plant seems to be a much more delicate plant than that of HOWE. Therefore I think we have to do with two different forms.

When I described the plant I placed it, though with much doubt, in the Fam. *Rhodomelaceæ* among "genera incertæ sedis",

my plant upon the whole showing so much likeness to a *Polysiphonia*. Now, of course, it has found its right place among the *Delesseriaceæ*. Its way of forming the cortex, the development of which I was not able to find out from my material, but which is easily seen in HOWE's plant, exactly shows its relation to this family.

152. **Tænioma perpusillum** J. Ag.
153. **Caloglossa Leprieurii** (Mont.) J. Ag.
154. **Delesseria tenuifolia** Harv.
155. **Martensia Pavonia** J. Ag.

156. **Asparagopsis taxiformis** (Delile) Coll. et Herv.

CONOLLY has in "Flora", Bd. 103, 1911, Heft 2, given a description of the Australian species *Asparagopsis armata* which ought to be compared with that of *Asparagopsis taxiformis* given above.

157. **Gigartina acicularis** (Wulf.) Lamx.

Hypneocolax nov. gen.

Thallus parasiticus, minutus, subhemisphæricus, processibus brevibus undique projectis, verrucæformis aut semistellariæformis parte basali nutrici adfixus et cum hospite arcte coalescens. Structura parenchymatica, cellulis plus minus seriatis radiatim flabellatis; interiores majores, exteriores minores corticemque formant. Sporangia in cellulis externis formata in duas sporas divisa. Antheridia in summo filorum breviorum creata, dense congesta totam fere superficiem plantæ occupantia. Cystocarpia sparsa in singulis plantis pluria in processibus formata, semiglobosa poro terminali non instructa.

158. **Hypneocolax stellaris** nov. spec.

Thallus ca. $^3/_4$ mm latus. Cuticula crassa, 20—25 μ lata. Sporangia in cortice formata in duas sporas divisa, long. 30 μ; lat. 16—22 μ. Cystocarpia globosa pluria in eadem planta praesentia, carposporas numerosas continentia; latitudo eorum 20—22 μ.

Upon a specimen of *Hypnea musciformis* some small wartlike or sometimes more stellate bodies were found (Fig. 433),

having shorter processes with broad bases and acute or more roundish apices everywhere, except at the side facing the host plant. As soon as I observed them I supposed that I had to do with a parasitic *Floridean* and after having found, not only plants with neutral spores, but also antheridial and female plants, this seemed quite clear and was also amply proved by closer examination.

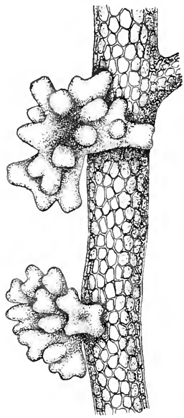

Fig. 433. *Hypneocolax stellaris* nov. spec. Two plants fixed to the host plant. (About 8:1.)

The parasite occurs in all parts of the host plant, upon young thin filaments as well as upon thicker main filaments; I have especially found many of them upon the tendrils of the *Hypnea*. The specimens attain the size of a pinhead, their diameter having a length of up to $^3/_4$ mm.

As the material has been preserved in alcohol I am unable to tell anything about the colour of the plant.

From a transverse section (Fig. 434, *a*, *b*, *c*) through the host and parasite is seen that their growing together is very intimate, the parasite having a very hyperplastic effect upon the tissue of the host. Thus the epidermal layer of the *Hypnea* is quite disorganized, its cells becoming in such a way transformed and intermingled among the cells of the parasite that it is generally quite impossible to say, where the one ends and the other begins. The parasite does not penetrate to any great extent into the tissue of the host. I have never found any of its filaments between the large cells in the medullary tissue of the *Hypnea*.

The figure 434 *b* shows a part of a transverse section of *Hypnea*, and the parasite. We see some of the large cells belonging to the central body of the *Hypnea*, but the very regular cortical layer of this plant is much damaged; perhaps two or three of the largest roundish cells are from this tissue, but this cannot be stated with certainty. And after having stained the transverse section in Hoffmann's violet, dissolved in glycerine and water it is easily seen that the cells of the parasite and those of the *Hypnea* are connected by pores quite in the same manner as de-

scribed by RICHARDS for *Choreocolax Polysiphoniæ*[1]) and thereby showing that we have to do with a real parasite.

From the transverse section is seen that the cells nearest to the host plant generally are the smallest, but they grow gradually larger. The cells in the middle of the tissue are roundish-polygo-

Fig. 434. *Hypneocolax stellaris* nov. spec.
a, transverse section of parasite and host. *b*. part of the same more magnified. *c*, longitudinal section of apex. *d*, laminated membrane. (*a*, about 40:1; *b* and *d*, about 250:1; *c*, about 100:1).

nal, rather irregular in shape with rather thick walls forming a parenchymatic tissue. The cells are more or less filled with rather large, roundish to oval grains of starchs. The cells of the parenchymatic tissue are usually arranged rather distinctly in rows. Towards the periphery the cells gradually become smaller and are distinctly arranged in rows, forming short filaments. The end

[1]) RICHARDS, H. M., On the structure and development of *Choreocolax Polysiphoniæ*, Reinsch. (Proceed. Americ. Acad. of Arts and Sciences, vol. 26, 1891, p. 46).

cells are elongated and when they have reached a certain size they may be divided into two cells by a longitudinal wall, and thereafter the basal ends of the cells are cut off by transverse walls (comp. Fig. 434 *c*, *d*).

The whole plant is at the periphery surrounded by a very thick cuticula about 20—25 μ thick. It is obviously lamellated like *Lobocolax*, as described by Howe[1]) (Fig. 434 *d*).

The apex of the projections is composed of a great number of filaments packed together and diverging in all directions.

In some of the specimens I have found some large cavities; I think that these originate from lobes which have grown together, because the thick cuticula, too, was partly present upon the wall of these.

Most of the specimens examined were sterile; I have found only four with neutral spores, one with antheridia and five with carpospores.

The neutral spores (Fig. 435 *a*) are formed in the cortical layer in such a way that after the division of the terminal cells by a longitudinal wall, as described above, one of the cells becomes the mother-cell of the sporangia. This cell becomes filled with dense contents and increases gradually in size. It is then divided by a transverse wall into two spores. I have never found the sporangia divided into more spores than two, and, as most of the sporangia seemed quite mature, I feel convinced that no further division takes place. The sporangia are about 30 μ long and 16—22 μ broad. They are formed over the whole surface of the plant.

In the male specimen found, the antheridial stands occur in extended patches covering nearly the whole surface of the plant. The epidermal cells are divided several times into thin filaments composed of small roundish cells, the uppermost cells of which become transformed into the antheridia and are gradually rounded off and get loose (Fig. 435 *b*).

The female plants found all had quite or nearly ripe carpospores. The trichogyne or the carpogonial branch have not been found at all, and I have therefore not been able to follow the development of the cystocarps. But, nevertheless, I think I have

[1]) Howe, M. A., The Marine Algæ of Peru (Memoirs of the Torrey Bot. Club, vol. XV, 1914, p. 90).

seen sufficient to be able to refer the plant to its systematic place, this without doubt being among the *Gigartinaceæ*, as the development of the cystocarp seems to proceed along similar lines as in the case of *Harveyella* and *Choreocolax*, though with some differences.

To judge from the youngest stages found the sporogenous filaments grow out, after fertilization, from the central cell in all directions between the rather loose parenchymatic tissue and send off here and there short ramified filaments from which the carpospores are formed. Gradually, as the carpospores increase in size and number, the cells of the parenchymatic tissue are squeezed together in such a way that a small globular space is formed which is filled with the carpospores (Fig. 435 *c*). These are roundish-triangular in shape. Their diameter reaches a length of about 20—22 μ. Near the base of the cavity I have seen a large multilobed cell most probably being the auxiliary cell after the fusing with the sterile cells. I have not found any carpostome, the spores most probably becoming free by dissolving or bursting of the wall. Several cystocarps are present in each plant; they are formed in the processes, these getting a hemispherical shape.

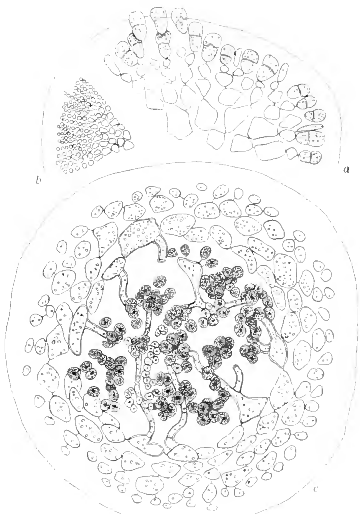

Fig. 435. *Hypneocolax stellaris* nov. spec. *a*, part of transverse section with sporangia. *b*, transverse section of male plant. *c*, transverse section of a cystocarp. (*a*, about 175:1; *b*, about 200:1; *c*, about 150:1.)

Compared with *Choreocolax* and *Harveyella*, as these are known from the descriptions by Sturch[1]) and by Richards[2]), my plant

[1]) In Annals of Botany, vol. 13, 1899, p. 83.

[2]) Richards, H. M., On the structure and development of *Choreocolax Polysiphoniæ* (Proceed. Amer. Arts and Sciences, vol. 26, 1891, p. 46).

differs from *Choreocolax* by the clusters of carpospores formed by the sporogenous filaments, while in *Choreocolax* a single, but very large spore is produced at each place; it further differs by the lack of any carpostome. *Harveyella* differs from our plant by the fact that the cystocarps form large extended bodies over the surface of the plant, and are not confined to small roundish bodies as in my plant. From both genera my plant differs by the sporangia being divided into two spores only.

The plant was gathered in shallow water near the shore in a sheltered locality.

It had tetraspores, cystocarps and antheridia in the month of January.

St. Croix: Lime Tree Bay at the south shore of the island.

159. **Gymnogongrus tenuis** J. Ag.
160. **Kallymenia perforata** J. Ag.
161. **Catenella Opuntia** (G. et W.) Grev.
162. **Agardhiella tenera** (J. Ag.) Schmitz.
163. **Rhabdonia ramosissima** (Harv.) J. Ag.
164. **Eucheuma isiforme** (Ag.) J. Ag.
165. **Wurdemannia setacea** Harv.
166. **Gelidiopsis rigida** (Vahl) Web. v. Bosse.
167. **Gracilaria confervoides** (L.) Grev.
168. — **ferox** J. Ag.
169. — **compressa** (Ag.) Grev.
170. — **caudata** J. Ag.
171. — **cylindrica** Børgs.
172. — **usneoides** (Mert.) J. Ag.
173. — **Wrightii** (Turn.) J. Ag.
174. — **lacinulata** (Vahl) Børgs.
175. — **dentata** J. Ag.
176. — **cervicornis** (Turner) J. Ag.
177. **Hypnea musciformis** (Wulf.) Lamour.
178. — **cornuta** (Lamour.) J. Ag.
179. — **cervicornis** J. Ag.
180. — **spinella** (Ag.) Kütz.
181. **Gloiocladia** spec.
182. **Rhodymenia occidentalis** Børgs.
183. **Coelothrix irregularis** (Harv.) Børgs.

184. **Chrysymenia Agardhii** Harv.
185. — **planifrons** (Melv.) J. Ag.
186. — **ventricosa** (Lamour.) J. Ag.
187. — **Enteromorpha** Harv.
188. — **pyriformis** Børgs.
189. — **Uvaria** (L.) J. Ag.
var. *occidentalis* Børgs.
190. **Coelarthrum Albertisii** (Piccone) Børgs.
191. **Champia parvula** (Ag.) Harv.
192. — **salicornoides** Harv.

General remarks.

Definition of Species.

It is a well-known fact that some species show wide variation while others are almost constant and do not offer any difficulty as to classification.

Whilst the classification favoured by some writers tends to the formation of many small species in spite of the fact that intermediate forms occur between them, others prefer to group into more comprehensive species those forms which are linked together by intermediate stages. It appears to me that the middle course is here the most convenient. When I have considered myself able to prove the existence of such intermediate forms I have thought it best to refer them to the species with which they have most in common.

But in order to finally decide the matter an extensive material is necessary. When the material at hand contains only few specimens it is safer to classify into separate species; they can always, when more material is at disposal, be united later, if necessary.

To take an instance from the West Indian algæ, I have pointed out that *Caulerpa cupressoides* is a very variable plant, the forms of which are very diverse, but nevertheless these are all referable to the same species, as the variations seem to be due to the environment and are connected with intermediate forms.

Halimeda incrassata is another example. HOWE divides this species into several smaller ones, while I, having found intermediate stages between the different forms, prefer to consider them as belonging to the same species.

It seems to me that we get a much better idea of the mutual relationship of the different forms, by connecting those which are obviously related, into larger species, than by dividing them up in a greater number of small ones.

This last renders it difficult to form a clear conception of their mutual affinities and equally difficult to compare the geographical conditions of the different floras.

Some remarks concerning the algal vegetation at the islands.

In the introductory remarks to my monograph of the West Indian *Caulerpas* I have mentioned the external conditions under which the algæ upon the whole live, and I can therefore refer the reader to what I then wrote as to the nature and situation of the coast and sea-bottom and to the fact that there is practically no tide at the islands in question.

But, as I have not dealt with the temperature of the sea, I may give here some figures which I owe to the kindness of Capt. SPEERSCHNEIDER of the Meteorological Institute, Copenhagen.

The numbers show the mean temperature for each month of the surface water in the sea at St. Thomas.

January	25,5	July	28,3
February	24,8	August	27,7
March	24,9	September	27,2[1]
April	25,6	Oktober	27,8
May	27,2	November	27,0
June	28,4	December	26,4

I regret that I am not in a position to give much information as to the algal vegetation and the associations etc. of which it is composed. I had planned to go to the islands in 1915 for the

[1]) For September a single observation only was made.

purpose of studying the algal vegetation, as during my earlier visits I had mostly been occupied with the flora, but the outbreak of the war suddenly put an end to my preparations for the journey.

When an algologist who is only familiar with the algal vegetation of our Northern seas — dependent upon a rocky coast or other firm substratum for its existence — for the first time comes in contact with the tropical algal vegetation, he cannot fail to be immensely struck with the extraordinary richness and variety of form of the tropical algal flora which flourishes on a loose and yielding sea-bottom and is formed of types which are altogether absent from the Northern seas. I briefly dealt with this matter for the first time in 1898 in the book written by Prof. Ove Paulsen and myself (Om Vegetationen paa de dansk-vestindiske Øer, Kjøbenhavn 1898, p. 4; also in Botan. Tidsskr. Vol. 22). Since then I have gone into the matter in more detail in later papers[1] and therefore I shall not deal further with it here.

Another really just as strange occurrence of algæ in the West Indies is the vegetation which is fastened to the roots of the mangrove (*Rhizophora mangle*). The algæ find the rather uneven surface of the roots a favourable place to fasten themselves, and the fact that the water can circulate freely round the roots also contributes to favour this habitat. Consequently the result is that those mangrove roots which grow in the water, where it is salt and not stagnant, are overgrown by a vigorous and often very luxuriant algal vegetation. I have also mentioned this interesting vegetation in an earlier paper, namely in the above quoted volume published on the occasion of Professor Warming's seventieth birthday.

Upon the coral reefs and upon the larger and smaller blocks broken off from these we find near the surface of the sea and in shallow water several *Caulerpa*-forms covering the blocks and

[1] Børgesen, F., A contribution to the knowledge of the marine Alga vegetation on the coasts of the Danish West-Indian Islands (Bot. Tidsskrift, vol. 23, 1900). An ecological and systematic account of the Caulerpas of the Danish West Indies (Kgl. danske Vidensk. Selsk. Skrifter, 7. Række, Naturv.-mathem. Afd. IV, 5, 1907). The algal vegetation of the lagoons in the Danish West Indies. (Biologiske Arbejder tilegnede Eug. Warming, den 3. Nov. 1911, København).

stones more or less abundantly[1]). In additions to *Caulerpa* many other algæ are characteristic of such localities; of the *Chlorophyceæ* we find for instance *Dictyosphæria favulosa* and *D. van Bosseæ*, *Valonia ventricosa*, *V. utricularis* and *V. macrophysa* all forming smaller or larger crust-like bodies, also *Cladophoropsis membranacea* occurs fixed as well as detached forming *Ægagropila*-like bodies upon the bottom. And these are joined with *Chamædoris annulata*, *Halimeda Opuntia* and *H. incrassata*, *Penicillus* and many others. Of *Phæophyceæ* we most frequently find several *Padina*- and *Dictyota*-species, tufts of *Ectocarpus*, *Colpomenia* and *Hydroclathrus* etc. and finally many *Rhodophyceæ*, of which the most characteristic are *Gelidiopsis rigida*, *Bryothamnion triangulare*, *Digenea simplex*, *Laurencia papillosa*, *Hypnea*- and *Spyridia*-forms, *Galaxaura*, *Amphiroa fragilissima* and other corallinaceous algæ, *Centroceras* and many other species, all forming larger or smaller tufts often intermingled between each other.

Upon the very exposed rocky coast of the northwest side of St. Croix several algæ occur so high above the sea-level that they are moistened only by the spray. Uppermost were found several *Myxophyceæ* and small tufts of *Laurencia obtusa* and *L. papillosa*, of *Dilophus guineensis*, *Dictyota ciliata* and *Padina gymnospora*. Amongst these, scattered tufts of *Chætomorpha antennina* were found in abundance and lower down *Polysiphonia ferulacea*, *Centroceras clavulatum* and *Ectocarpus breviarticulatus*. Extensive patches are formed by *Aglaozonia canariensis*, which covers the very uneven rocks with its fleshy — cartilaginous red-brown thallus; now and then *Ralfsia expansa* and *Lithothamnion*, too, form smaller or larger crusts. This association can perhaps be compared with that of *Callithamnion arbuscula* at the Færöes, the tropical association like the northern one living in such exposed places upon steep rocks where it is exposed to the whole force of the sea, and some of the tropical algæ, too, being able to retain the water like small sponges.

Another characteristic association of algæ, corresponding to the *Bangia—Urospora*-association of the Færöes was found in rather exposed places upon the steep rocky coast at Cruz Bay,

[1]) Børgesen, F., An ecolog. and system. account of the *Caulerpas*, l. c. p. 346.

St. Jan. The components of the West Indian algal communtiy consisted of *Enteromorpha plumosa*, *Chætomorpha* and *Rhizoclonium*-species, *Pylaiella fulvescens* etc., all thread-like algæ.

In crevices in rocks and in small caves, especially in rather shady places, several small algæ are able to grow a little above the surface of the sea, so they may become rather dry when the sea is calm. In such places in Store Nordside Bay (Magens Bay), St. Thomas, a vegetation was found uppermost composed of *Bostrychia tenella*, together with several *Myxophyceæ*, *Chætomorpha antennina*, *Ch. brachygona* and other forms, *Struvea delicatula*, *Hypnea spinella*, *Centroceras clavulatum*, *Sphacelaria tribuloides* and *furcigera*, *Tænioma perpusillum*, *Wrangelia Argus*, *Enteromorpha plumosa*, *Polysiphonia ferulacea*, *Ectocarpus* etc. But the great number of these species are yet, for the most time, covered by the sea, living quite near the surface. The rocks washed by the spray from the sea were covered by crusts of various Lichens[1]) and below *Ralfsia expansa* and *Lithothamnion* were found intermingled with the Lichens.

Upon stones and shells in somewhat exposed places crust-like algæ are often found in shallow water, for instance *Ralfsia expansa*, *Hildenbrandia prototypus*, *Peyssonnelia* etc. And upon stones scattered on sandy bottom in more sheltered places in shallow water *Agardhiella tenera*, *Castagnea Zosteræ*, *Rosenvingea Sanctæ Crucis*, *Ectocarpus*, *Hypnea musciformis*, *Spyridia filamentosa*, *Grateloupia* etc. grow in larger and smaller tufts.

Upon rocky and stony coasts often in bays, but also in rather exposed localities *Sargassum* and *Turbinaria* form together an often luxuriant vegetation, exactly corresponding with the Fucaceous vegetation of the Northern seas.

A characteristic algal vegetation occurs on piers and rocks over which the waves are rolling, for instance in the inner harbour of St. Thomas where the water was much polluted. The most

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[1]) According to the determination of Wainio, I collected here: *Parmelia lusitana* Nyl. var. *decipiens* Wain., *Pertusaria præterrisa* Wain., *Placodium Boergesenii* Wain., var. *squamosa areolata* Wain., *Placodium diplacium* (Ach.) Wain.; *Physcia integrata* Nyl., *Physcia picta* (Sw.) Nyl.; *Rinodina pyxinoides* Wain.; *Buellia conspirans* Nyl., *Buellia orcularia* Wain.; *Heppia Bolanderi* (Tuck.) Wain.; *Collema acarosporoides* Wain.; *Synalissa lichinella* Wain.; *Pyrenopsis negans* Wain.; *Psorotichia Boergesenii* Wain.

prominent components of this vegetation are *Grateloupia dichotoma* and *Gr. cuneifolia*, *Enteromorpha lingulata*, *Ulva Lactuca*, *Gymnogongrus tenuis*, *Bryopsis plumosa*, *Hypnea cervicornis* and *musciformis*, *Spyridia filamentosa* and *Sp. clavata* etc.

In deeper water at a depth of about 5 fathoms near Buck Island at St. Croix a rich vegetation of various algæ was present; among the most characteristic were *Griffithsia globifera*, *Liagora pinnata*, *Wrangelia penicillata*, *Laurencia Poitei* and *L. obtusa*, *Hypnea cervicornis*, *Gracilaria lacinulata*, *Digenea simplex*, *Amphiroa fragilissima*, *Dilophus Guineensis*, *Dictyota ciliata* and *D. volubilis*, *Zonaria variegata*, *Udotea Flabellum*, *Penicillus Lamourouxii*, *Caulerpa cupressoides*, *Neomeris annulata* and several others

In a similar depth off Frederikssted, St. Croix, was found: *Penicillus capitatus* and *P. pyriformis*, *Udotea Flabellum* and *U. conglutinata*, *Dictyota indica*, *D. volubilis* and *D. linearis*, *Amphiroa fragilissima*, *Jania cubensis*, several *Galaxaura*-species *Cladophora crispula*, *Champia parvula*, *Spyridia filamentosa* and *Sp. clavata*, *Digenea simplex* and many others.

In the sea at St. Thomas west of Water Island in a depth of about 10—15 fathoms a vegetation composed mostly of *Chlorophyceæ* and among these especially representatives of *Codiaceæ* were found. Of this family were present here: *Penicillus capitatus*, *P. pyriformis* and *P. Lamourouxii*, *Udotea cyathiformis*, *U. verticillosa* and *U. Flabellum*, *Arrainvillea nigricans*, *A. Mazei*, *A. asarifolia*, *Halimeda Tuna* forma *platydisca*, *H. incrassata* and *Cladocephalus luteofuscus*. Of other algæ: *Caulerpa prolifera*, *C. crassifolia*, *C. cupressoides* var. *flabellata* etc. *Dictyosphæria favulosa*, *Valonia ventricosa*, *Microdictyon umbilicatum*, *Anadyomene stellata*, *Callithamnion* spec., *Cottoniella*, *Dictyurus occidentalis*, *Gracilaria lacinulata*, *Zonaria variegata* and several others.

But the richest flora of all was found in the sound between St. Thomas and St. Jan in a depth from about 10 to 20 fathoms.

Here was found: *Dasya elegans*, *D. ramosissima* and *D. caraibica*, *Lophocladia trichoclados*, *Wrightiella Tumanowiczii*, *Wrangelia bicuspidata* and *W. penicillata*, *Delesseria tenuifolia*, *Asparagopsis taxiformis*, *Gracilaria cylindrica* with *Callithamnion cordatum*, *Rhodymenia occidentalis*, *Rhabdonia ramosissima*, *Griffithsia globifera*, *Callymenia perforata*, *Bryothamnion Seaforthii*, *Galax-*

aura, *Chrysymenia ventricosa*, *Chr. Enteromorpha*, *Chr. Agardhii*, *Chondria dasyphylla*, *Champia salicornoides* and *Ch. parvula*, *Mesothamnion caribæum* etc.

Of the *Chlorophyceæ* the most striking forms were *Caulerpa Ashmeadi*, *C. crassifolia*, *C. prolifera*, *C. clavifera*, *C. cupressoides* var. *flabellata*, *C. Webbiana*, *Struvea elegans*, *Rhipilia tomentosa*, *Chamædoris annulata*, *Udotea cyathiformis*, *U. verticillosa*, *U. Flabellum* and *U. spinulosa*, *Valonia ventricosa*, *Penicillus pyriformis*, *Avrainvillea nigricans*, *Avr. asarifolia*, *Halimeda discoidea* var. *platyloba*, *Anadyomene stellata*, *Acicularia Schenckii*, *Dictyosphæria favulosa*, *Codium tomentosum* and *C. isthmocladum* and several others.

In the strait north of St. Jan between Tortola the algal vegetation had another composition. Here *Chrysymenia Uvaria* was often found in large quantities.

Some remarks on the geographical position of the West Indian algal flora.

We see from the investigation now concluded, concerning the algæ found round those West Indian islands which formerly belonged to Denmark, that we have dealt with 90 species of *Chlorophyceæ*, 45 of *Phæophyceæ* and 192 of *Rhodophyceæ*, this last mentioned being therefore by far the largest group. Compared with the very high number of 788 species, which MURRAY has included in his "Catalogue of the marine algæ of the West Indian region"[1]), 327, the total number found by me, is certainly not a large number. But we must remember that the *Myxophyceæ* are included in MURRAY's list and moreover, as he himself admits, a large number of the West Indian species in his catalogue are doubtful ones, so this large number will certainly get much reduced on critical examination.

If we now will try to make a comparison between the West Indian algal flora, as known from the islands in question, and other algal floras, a comparison with other West Indian floras is, of course, the most obvious one. But this I have not done here, as, with the exception of the Bermuda Isles and in lesser degree.

[1]) In Journal of Botany, 1888—89.

Barbadoes, Jamaica and Guadeloupe, the West Indian region is still rather poorly investigated and a comparison is therefore not very satisfactory and besides I consider such a local comparison but of minor interest.

On the other hand, a comparison between the West Indian algal flora on the one side of the Atlantic Ocean and that of the Atlantic-Mediterranean area on the other side of the ocean, and a comparison between the West Indian algal flora on the one side of the American Continent and the flora of the Indo-Pacific Oceans on the other side of the Continent would be of great interest.

A priori, one would be absolutely inclined to think that the similarity between the two last mentioned floras must be very small or non existent as the American Continent reaches towards the North as well as towards the South into cold seas which makes any mixing of the algal floras from the warm parts of the two oceans impossible. However, we shall soon see that the similarity between these areas is even remarkably great.

In the table below a survey is given on the distribution of the West Indian algæ in the other areas.

Total number af species found	Species found in the West Indies and surrounding seas only	Species hitherto only found at the islands in question	West Indian species also found in the Mediterranean Sea and adjacent parts of the Atlantic.	West Indian species also found in the Indo-Pacific Ocean
Chlorophyceæ: 90 ...	33	11	35	46
Phæophyceæ: 45 ...	20	5	14	18
Rhodophyceæ: 192 ...	108	46	63	47
In all: 327 ...	161	62	112	111

It is seen from this table that of the 327 West Indian species 161 have hitherto been found in the West Indies and on the adjacent American shores of the Atlantic ocean. Of these 161 species 62 have hitherto been found at the shores of the former Danish West-Indies, but it is to be expected that most of these species will also be found later in other parts of the West Indian region when this is more thoroughly examined. Several species from these islands have already been found at the Bermudas, according to Collins

and HERVEY's newly published work on the algal flora of these islands.

Of the remaining 166 West Indian species, 112 species are also found in the Mediterranean and at the warmer Atlantic coasts of Europe and Africa and 111 are likewise found in the Indo-Pacific ocean. Practically speaking the same number of species is therefore common to both of the areas in question, and the West Indian algal flora may therefore be said to be equally related to both the different areas. If we look at the *Chlorophyceæ* alone we shall meanwhile find that they occupy a somewhat different position; of this group 90 species are found at the islands and of these species 46, that is more than the half, are common to the Indo-Pacific, while only 35 are found both in the West Indies and in the Mediterranean and adjacent region of the Atlantic. With regard to the *Phæophyceæ* the corresponding numbers are 18 and 14. On the other hand the West Indian representives of the *Rhodophyceæ* are more closely related to the Mediterranean-Atlantic flora (63 species common to both) than to the Indo-Pacific ocean (only 47 species in common).

From the above we have seen that the West Indian algal flora does resemble in an almost equal degree the flora of the Indo-Pacific ocean and that of the Mediterranean Sea and adjacent warm parts of the European and African Atlantic coasts — in the case of the *Chlorophyceæ* the resemblance being even far greater — and that in spite of the fact that the two areas are apparently so distinctly separated.

MURRAY was the first to point out this striking similarity. In his paper; "A comparison of the marine floras of the warm Atlantic, Indian Ocean, and the Cape of Good Hope"[1]) he has compared these areas thoroughly. As to those of the Indo-Pacific ocean and the West Indian he writes: "We have here two tropical marine floras cut off from each other by a permanent continental area, and communicating only via the Cape". And he tries to explain in the following way how this great similarity has arisen: "That these floras have been periodically mingled at the epochs of warmer climate at the Cape seems a reasonable conclusion with regard to a group of such antiquity as the Algæ". That some species by passing the Cape may have been able to

[1]) In Phycological Memoirs edited by GEORGE MURRAY, Part II, 1893.

migrate this distance is, of course, not impossible, but in order to explain the great similarity between the West Indian and the Indo-Pacific algal flora his explanation is not sufficient. It is well known that, owing to geological reasons, the supposition has been adopted that the Pacific Ocean and the Atlantic have been in direct communication through Central America as late as in the Tertiary Period. But if this is the case the algal floras of both oceans have then had the opportunity of easy communication.

Regarding the geographical distribution of the *Caulerpas*, SVEDELIUS[1]) has adopted this explanation as the most natural one. In comparing the 21 species of *Caulerpas found* by him at the shores of Ceylon with those found in the West Indies, SVEDELIUS discovered that no less than twelve (according to his definition of species), were common to both areas. SVEDELIUS writes: "It is very remarkable that the tropicál algal district in the Atlantic is almost confined to the West Indies. This probably depends on the eastern coast of South America, just as the western coast of Africa — as MURRAY points out, not offering suitable habitats for algal growth. But then one can scarcely assume that, even if warmer water washed the south coasts of South America and especially of Africa, a more luxuriant algal vegetation should have been harboured then than is the case to-day, seeing how little suited they are said to be for algal growths of any kind. I therefore think that the communication and the relationship between the floral districts of the Indian-Pacific Ocean and the West Indies can be more naturally explained in another way, i. e., that these districts once had direct communication over the districts where now the Central or South American continent separates the two great oceans".

Of the 11 species of *Caulerpa* found at the West Indian Islands examined by me, 9 are also found in the Indo-Pacific Ocean, and if it might be proved that *Caulerpa ambigua* Okamura is like my *Caulerpa Vickersiæ* no less than 10 are common to both areas, the *Caulerpa Ashmeadi*, being the only specific West Indian species found, having a rather restricted distribution. And just the fact that, which I have mentioned above, it is the *Chlorophyceæ*, and among them especially such old genera as *Caulerpa*,

[1]) SVEDELIUS, N., Ecological and systematic Studies of the Ceylon Species of Caulerpa (Ceylon Marine Biological Reports, Nr. 4).

Dictyosphæria, *Valonia* and *Codium*, that have most species in common in both oceans, while the *Rhodophyceæ* being surely of more recent origin, show less correspondance, seems to strengthen the supposition that the great number of species common to both oceans is due to this earlier communication between the two oceans.

In this connection it is also of interest to mention OSTENFELD's[1]) conclusion regarding the marine phanerogamic plants. Of these, 6 species which are surely the representatives of very old types, occur in the West Indies and 4 of these are closely related to four corresponding forms occurring in the Indo-Pacific ocean, and this great resemblance is, according to OSTENFELD, only to be understood by the species having migrated through the Tertiary Central American strait into the Caribean Sea and, after having been shut in here, they have developed into the species which we now find in the West Indies.

In just the same way, in fact, resemblances between zoological groups have been accounted for.

The result of the above-mentioned comparison can therefore briefly be summed up thus: The algal flora of the West Indian islands in question shows a strikingly great resemblance to that of the Indo-Pacific ocean. This applies especially to certain, undoubtedly very old, groups of *Chlorophyceæ*. The *Rhodophyceæ*, on the other hand, show less resemblance to those from the Indo-Pacific Ocean, being more closely related to the algal flora occurring in the Mediterranean-Atlantic territory.

The great similarity between those two algal floras: the West Indian and the Indo-Pacific, which in our days are so distinctly separated, has its natural explanation in a prehistoric old connection between the two oceans.

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[1]) OSTENFELD, C. H., On the geographical distribution of the Seagrasses (Proc. Roy. Soc. Victoria, 27, (N. S.), Part II, 1914, p. 179).
OSTENFELD, C. H., Havgræssernes Udbredelse i Verdenshavene, „Naturen", 1917.

Concluding Remarks.

During the war the Danish Government found itself compelled to sell to America our small, but beautiful Danish West Indian Islands. In spite of the opposition of a large part of the Danish people, and the protest, not only of many eminent men of science, but also of many prominent commercial and naval men, the Dannebrog, after having waved over the islands for two and one half centuries, was lowered for ever in 1917. The United States took over the islands in the year 1917, that is, long before the publication of the later sections of this work, so the title of these later sections is in this respect misleading.

It was in 1892 that, I as a young man, visited our West Indian Islands for the first time, and among other things began to collect and examine the marine algæ along the coasts of the islands encouraged by Prof. WARMING[1]) who just at that time visited the islands. I, of course, chose these islands because they were Danish, and because I thought it our duty to study their nature. I little thought to have the grief of seeing Denmark lose the islands; this has not only been a personal loss, but also a considerable loss for the Danish Natural Science. I want in this connection to mention the fact which Dr. TH. MORTENSEN and I[2]) have already pointed out, that the sea round the islands is full of incomparable treasures, for the Zoologist especially, on account of the great depth of the sea just off the coast, and the botanist will scarcely be able to find a more diverse algal vegetation than the one which I have found in the sound between St. Jan and St. Thomas and, in fact, in all the adjoining waters of these islands. The sea has nearest to them a depth of about 10 to 20 fathoms and a very rich vegetation consisting of the most interesting types of algæ covers the sea bottom. A biological station, near Cruz Bay, St. Jan, for example would always be able to supply the students with the

[1]) Professor WARMING, who has always shown the greatest devotion to the interests of his country, has continually emphasized the young botanists' duty to investigate the distant parts of our kingdom. It was through his initative that the botanical survey of the Færöes was started, and the "Botany of the Færöes" was published as a result. And when this survey was concluded, an investigation, on similar lines, of the botany of Iceland was initiated, and as a result of this a couple of volumes have already appeared.

[2]) MORTENSEN, TH. og F. BØRGESEN, En biologisk Station i Dansk Vestindien. „Atlanten", vol. I, 1904, p. 89.

most varied material. At this place one can dredge the bottom again and again and continually find interesting forms, without even being troubled by corals which often in the West Indies, near St. Croix for instance, renders dredging difficult.

In the introduction to the *Chlorophyceæ* I have given a short account of earlier collectors of algæ, but omitted to mention there that the "Challenger" expedition also visited St. Thomas and made dredgings and that some of the many *Codiaceæ*, which have been found just at this island, were dredged by that expedition.

Also several naval officers on the Danish men of war, which in the course of time were stationed at the islands, have made many collections there, and though these collections have a haphazard character and, of course, generally consist of algæ which have drifted ashore or those from the littoral zone, we have, nevertheless, to thank many of these collectors for the specimens on which many of our first descriptions have been based. Indeed not a few of the West Indian Algæ were first described upon specimens from the Danish Isles.

While collecting material my procedure has always been to sort the gathered material immediately on my return in such a way that of each species collected some specimens were dried and others laid in alcohol, and my determinations and examinations are chiefly based upon the last mentioned material. If I therefore, with regard to the new forms, had to speak about "type-specimens", in the way that word is especially used in America, mine are mostly to be found in bottles and in my preparations.

Before concluding I should like to thank all those who in different ways have helped me with my work. Besides those I already have mentioned in the introduction to the sections treating of the green and the brown algæ, I should like to convey my warmest thanks to the specialists who have assisted me in working out certain groups, particularly Mme Paul Lemoine of Paris who worked out the *Melobesieæ*, and Mme Weber-van Bosse in Eerbeck who was so kind as to give a description of my collections of *Rhizophyllidaceæ* and *Squamariaceæ*. My thanks are also due to Dr. Henning E. Petersen who, by his great knowledge of the group *Ceramieæ*, was the best able to deal with this group.

I should also like to thank the American algologist Dr. M. A. Howe who sent me large collections of West Indian algæ, which have been of great use to me for purposes of comparison, concerning many doubtful forms.

Then I owe a debt of gratitude to the late Prof. W. G. Farlow for his valuable assistance and for the interest he always showed in my work, and to the late F. S. Collins, who sent me much valuable material of West Indian algæ, and through his extensive knowledge of the American algal flora supplied me with much useful information.

Moreover I am highly indebted to Prof. C. Lindman of the Riksmuseum, Stockholm, and Prof. N. Svedelius of the Botanical Museum, Upsala, for the loan of algæ to compare with my collections. Likewise I am sincerely grateful to the Professors Murbeck and Nordstedt for their courtesy in giving me access to Agardh's Herbarium in Lund.

Finally I seize the opportunity to thank my colleague, Prof. Rosenvinge, to whom I owe much important imformation and who, as editor of Dansk Botanisk Arkiv, has assisted with the reading of the proof-sheets.

Mr. Ove Rostrup has helped me with most of the drawings, and my best thanks are due to him for the trouble he has taken.

Then I should like to thank most cordially Mr. A. D. Cotton of Kew, who has done me the great service of reading my proof-sheets, by which those errors, which easily arise when a foreigner has to write a language not his own, have been as far as possible put right.

Finally I want especially to thank the Trustees of the Carlsberg Foundation, not only for the continued grant for the reproduction of the many drawings, but particularly for the special grant for the printing of the last part which otherwise must have waited, owing to the high cost of printing at present.

With this I take leave of those beautiful small islands where so many of my thoughts and so much of my work have been centred for so many years, and the parting is the more painful since the tie, which bound the islands to my native land, has been severed.

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